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THE JOURNAL OF
GOOD LIGHTING

Official Organ of the Illuminating Engineering Society

FOUNDED IN LONDON 1908

Edited by
J. STEWART DOW

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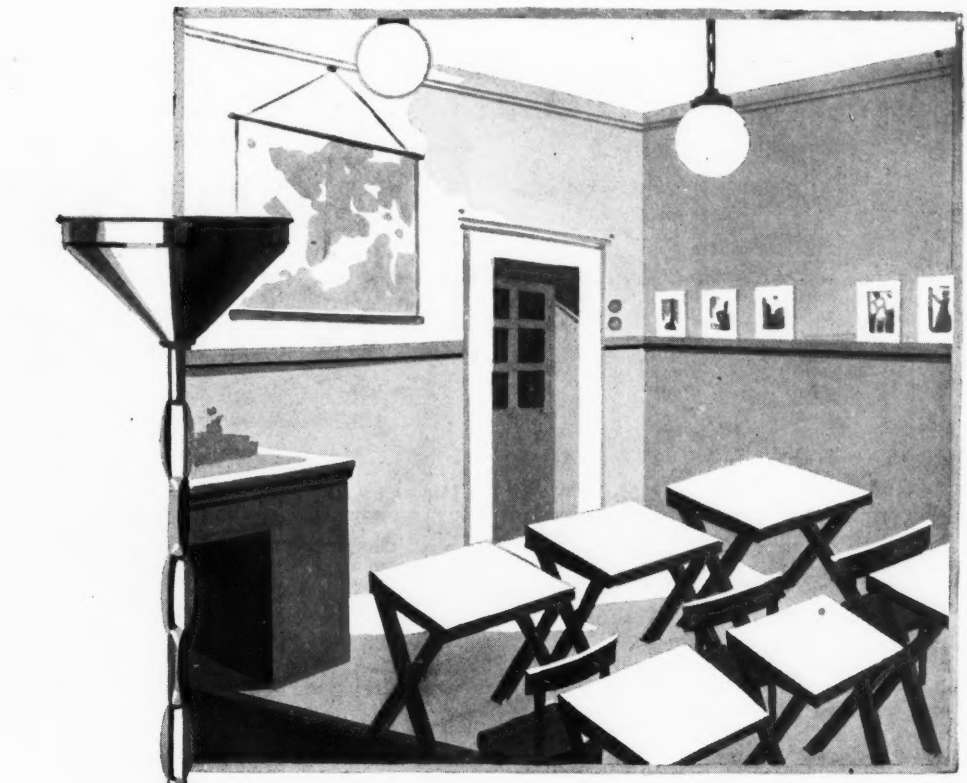

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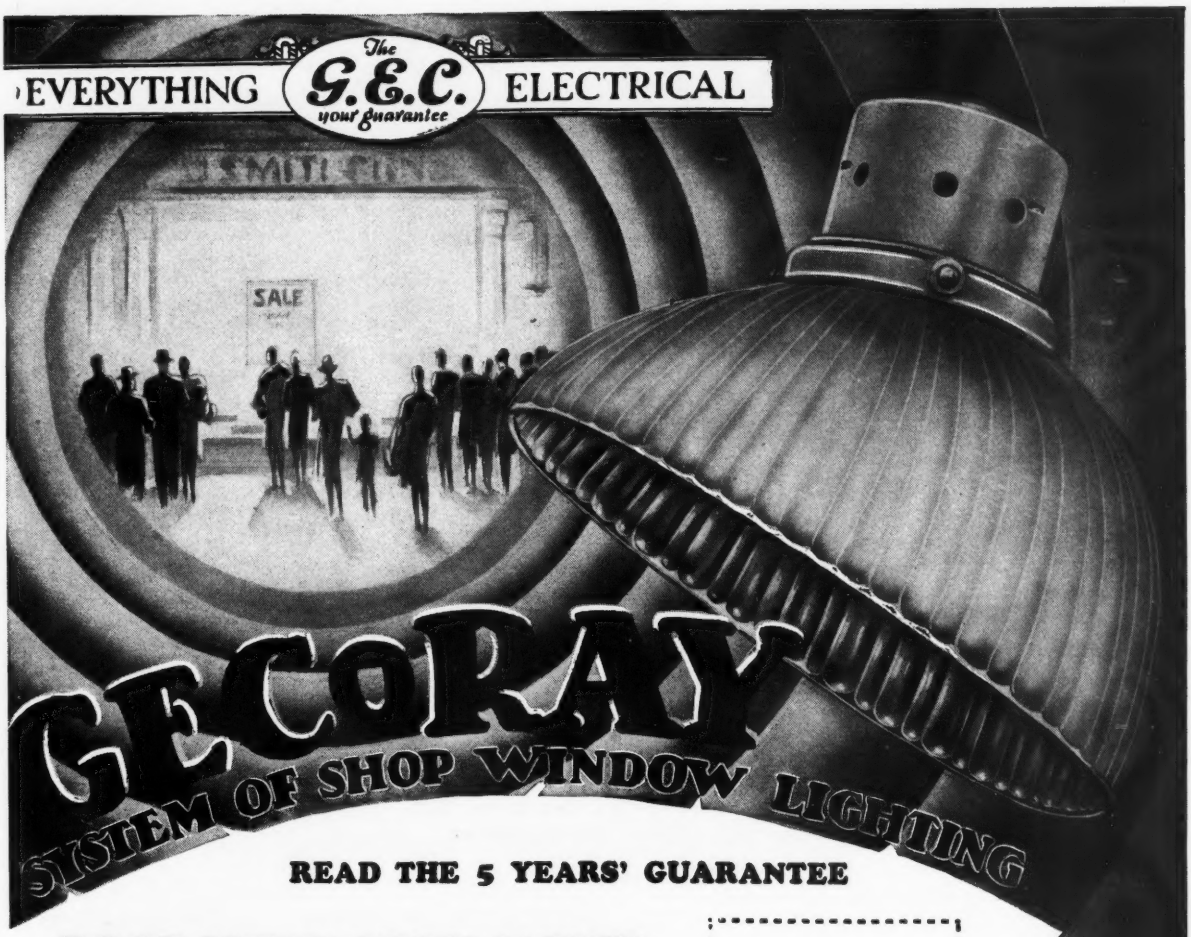

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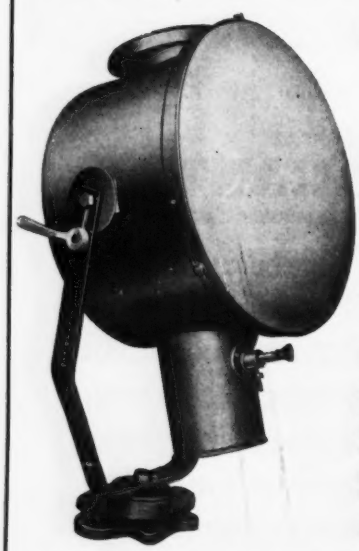

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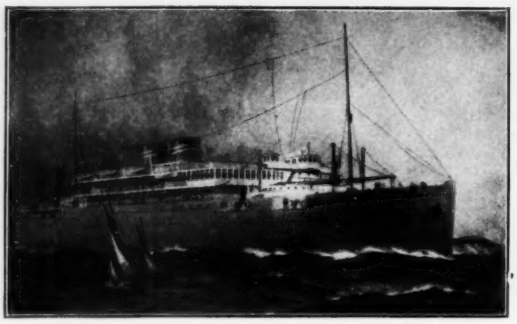

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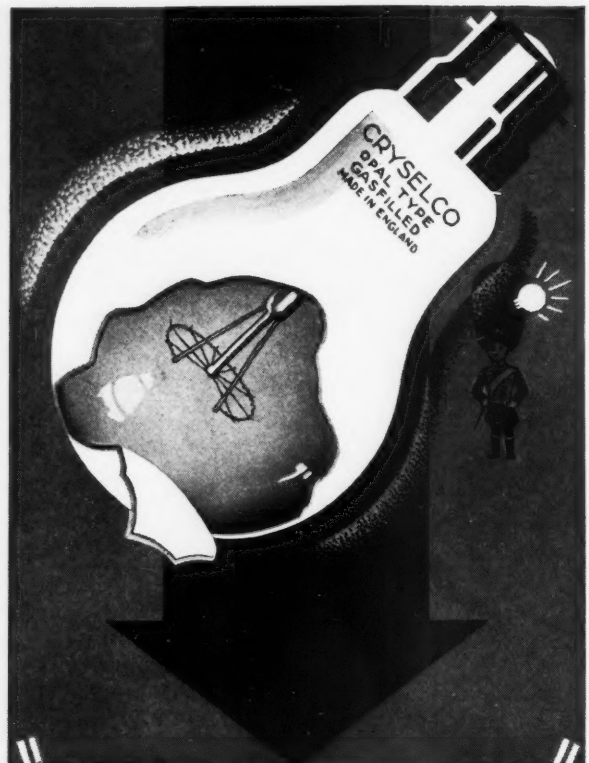

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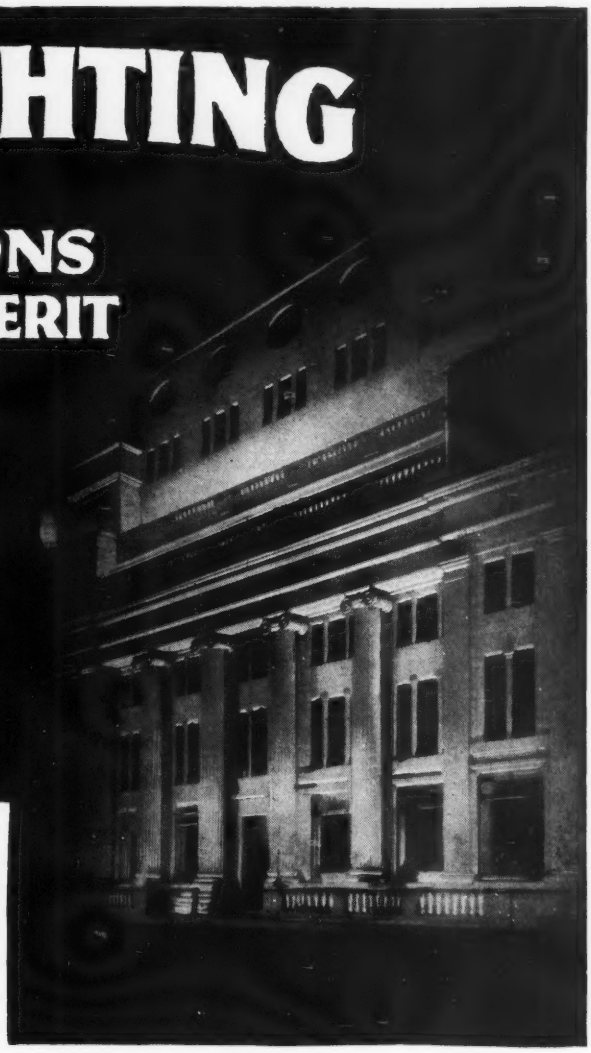

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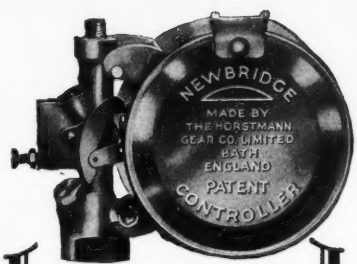

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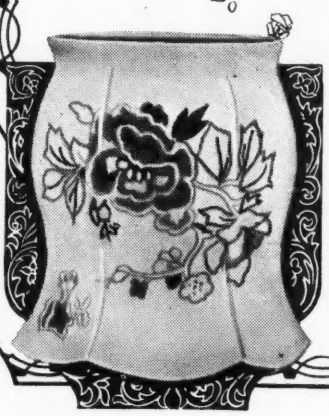

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The Lighting of Offices and Public Buildings

MR. J. A. MACINTYRE'S paper on the above subject (see pp. 290-294), read before the Illuminating Engineering Society on November 14th, falls into three main divisions. There is, firstly, the general discussion of natural lighting; secondly, the remarks on the special problem of lighting pictures in art galleries; and, thirdly, the section dealing with artificial lighting in offices.

Most methods of improving natural lighting are open to objections. Perhaps the use of mirrors, advocated by the author, is better than some others, though internal mirrors strike one as unsightly, and even external mirrors are apt to prove an eyesore. The double application of mirrors to improve the lighting of a picture, mentioned in the paper, certainly had very striking results. Yet one may doubt whether the device, here successfully used in deference to the views of the artist, gave better results than could have been more simply attained by the use of artificial daylight.

The natural lighting of the National Gallery has been the subject of much care and study. It is gratifying to hear that Gallery XIII is generally considered an object lesson; also that the artificial lighting of the National Gallery and the Gallery of British Art is now being considered. Some difference in opinion in regard to the quality of light seems still to exist. An approximation to daylight is desirable with a view to displaying colours. It is sometimes objected that the effect is "cold." We venture to think that when this impression is justified it is due either to unduly rigorous imitation of "north light" or to faulty decorative design.

The author's estimate of the intensity of illumination requisite is a moderate one—4 foot-candles he deems fully adequate, whilst many water-colours look quite well under 2 foot-candles. It is possible that many people will advocate higher values. One thing seems to us evident: the pictures should be the most brightly lighted objects in the gallery. Readers may recall an interesting discussion on the lighting of picture galleries so far back as 1914, when the late Mr. Joseph Pennell* entered a forcible plea for the viewing of illuminated pictures by visitors who were themselves in subdued light. In such cases the determination of the requisite illumination is very largely a matter of contrast. It will be admitted that the pictures should be the brightest objects in the field of view, though it is perhaps debatable whether the centre of the room should be left in complete shadow.

* *Illum. Eng.*, March, 1914, p. 156.

This question of contrast is likewise an element in determining intensities of illumination in offices. Mr. Macintyre's approval of the value proposed in 1920 by an Advisory Committee, i.e., an average of 3 foot-candles, and an absolute minimum of 2 foot-candles in public buildings, is likely to provoke some criticism. Very much higher values are commonly adopted in commercial offices. Yet, as he truly says, we really do need fuller scientific evidence for much higher values. There is good reason to believe that one's judgment is influenced greatly by comparison. Only a few years ago 2 foot-candles seemed to most of us quite a respectable illumination. To-day most of us would no longer tolerate such a low value. Why this change? In a great measure one is doubtless guided by experience of higher values in other interiors one visits. Even assuming that 2 foot-candles meets the physical requirements of the *eye*, it may no longer satisfy the *mind*, aware of greater generosity in light elsewhere! Possibly the general prevailing use of overhead general lighting also tends to create a demand for higher values, since the actual objects on the table may then be little brighter, or even less bright, than their surroundings. If exacting work is to be done there remains a good case for local lighting which renders high illuminations economically feasible, and enables the working material to be made the brightest object in the field of view.

We are quite willing to believe that, up to a point, higher illuminations enable people to see better, and (a somewhat different but often more important matter) to carry out a visual process more quickly. It is quite probable also that brighter conditions have a certain stimulating influence on the mind, inclining people to put forth greater efforts. We confess frankly that our own eyes, which at one time were apparently satisfied with 2 foot-candles, now prefer four, or even six. But where is the upward movement to end? The limit must depend on the purpose for which the light is applied, and may vary for different industrial processes. Removal of other defects—elimination of glare and reversal of inconvenient contrasts—may sometimes prove as effective as furnishing more light. Finally—and this is again a point on which some people hold strong views—quality of light may be as important as quantity. Is an approximation to the colour of daylight an aid to vision or not? All these questions can only be satisfactorily settled by scientific experiment, and by tests carried out repeatedly on a considerable scale.

The Efficiency of Light Production

THE Inaugural Address delivered before the Institution of Electrical Engineers by their new President, Mr. C. C. Paterson, on October 23rd, reviewed research in its broadest aspects. Much that was said regarding the possibilities of research and its value to the electrical industry was of great general interest. We propose, however, to confine ourselves to one or two topics of special interest to those concerned with lighting problems.

The first of these was the utility of frequency of occurrence curves, which serve to illustrate deviation from the normal. Curves representing performances of electric lamps were presented. The shapes characteristic of a well-established product, a less-mature product, and a product subject to adjustment were shown. Such graphs would be of considerable utility in another direction, i.e., in studying the fluctuations of voltage at consumers' terminals. The recognized limit of variation is ± 4 per cent., but in practice this limit is frequently exceeded. This condition obviously imposes a handicap on lamp manufacturers, and tends to render illusory some of the advantages of a standard specification. From the standpoint of the illuminating engineer such fluctuations are highly inconvenient. As a result, the actual illumination from incandescent lamps may vary by ± 20 to 25 per cent. The difficulty in framing specifications in such circumstances is manifest. Therefore, whilst we are aware of the difficulties, we do suggest that one ultimate aim of the electrical industry should be to keep the declared voltage within narrower limits.

The third topic, which occupied the final section of the address, was efficiency of light production. By transforming power directly into light of maximum visibility of wavelength 5550A, about 670 lumens per watt should theoretically be obtained. The luminous efficiency of the larger sizes of modern tungsten-filament lamps does not exceed 18 lumens per watt. It is true that monochromatic light of wavelength 5550A would have a disagreeable yellowish-green hue. But even assuming a satisfactory white light, resembling average sunlight, 200 lumens per watt would seem possible. There is, therefore, still much distance to travel.

At present most of our sources of light depend on incandescence. But the maximum efficiency to be derived from an incandescent black body, at a temperature near 6,300° K., is about 93 lumens per watt. But there is no possibility of approaching this limit. Tungsten melts at 3,600° K., and at this temperature would give about 50 lumens per watt. In practice only very much lower temperatures than this are feasible. Ordinary gasfilled lamps do not yield more than 10 to 18 lumens per watt, according to type. Of known elements none seems likely to prove more serviceable than tungsten. The only remaining possibility would seem to be high melting point compounds such as carbides. These have been tried, but not with promising results.

The most fascinating field for experiment at the moment would seem to be gaseous illuminants. Until recently the luminous efficiency of gaseous-discharge tubes was relatively low, but with the hot-cathode discharge tubes, first tried in America and since developed by Pirani in Berlin, yield 12 to 50 lumens per watt. Such sources give a linear spectrum and peculiar colour. It might be possible, however, by combining tubes giving different colours, to obtain a light which is at once efficient and agreeable to the eye.

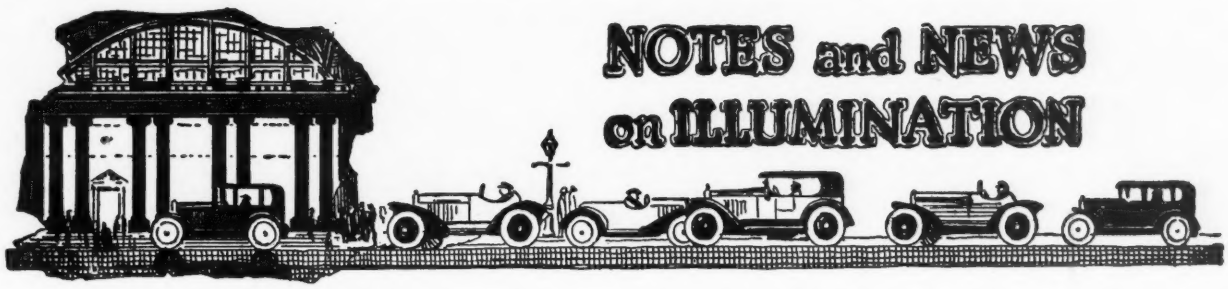
The Efficiency of Light Wells

THE report of Mr. H. F. Meacock and Mr. G. E. V. Lambert on the above subject, which is now issued by the Department of Scientific and Industrial Research, makes a timely appearance in view of the contents of Mr. Macintyre's paper before the Illuminating Engineering Society, which is dealt with elsewhere in this issue. As the sole purpose of a light well is to enable certain rooms in a large building to receive adequate access of daylight, the selection of its dimensions and the nature of the surface of the inner walls are obviously of great importance. In particular it is desirable to have some idea of the amount of daylight that will penetrate to the bottom of the well, so as to know whether the light well is really worth while. Land in the heart of a great city is frequently extremely valuable. When a large building is erected it is imperative to make the utmost use of the site and to get in as many rooms as possible to serve as offices. For this reason some have seriously doubted whether light wells in such circumstances are ever really worth building. It has been urged that the amount of daylight that can thus be admitted to the lower floors is not worth the sacrifice of space, that it would be better and cheaper to rely entirely on artificial light (which in any case will be necessary during a considerable part of the day in winter) and to eliminate windows, seeing that adequate ventilation can now be ensured by other means.

There is something to be said for this view. In any case, it is essential to have a clear understanding what light wells can do, and, admittedly, they have in the past been constructed on somewhat rule-of-thumb principles. The report just issued is therefore welcome. Mathematical treatment of the problem is obviously difficult, and the authors therefore fell back on the plan of using small-scale models. This method depends on the principle that the amount of daylight reaching any point in a building is the same, irrespective of its size, provided the proportions remain the same. In this case only the ratios, length-breadth and depth-breadth need be considered, and results of tests on a small-scale model may be applied to a full-sized building. As in other problems relating to natural light, we are concerned with the " daylight factor," which is here equal to the ratio of the brightness of the wall to the brightness of the sky, divided by the reflection factor of the wall.

The model adopted in these investigations is described and illustrated. Tests have been made for a large number of model wells of different dimensions, coated with materials of various reflecting powers. Numerous diagrams relating daylight factor to depth and length for various reflection factors are derived from these experiments. In addition, the authors are able to deduce an empirical formula enabling the daylight factor at the bottom of any well to be estimated with fair precision when its dimensions and the reflection factor of the surface are known. This method is really based on two distinct operations and expressions, determining respectively the daylight factors due to direct and reflected light.

White tiles having a reflection factor of 73.5 per cent. were investigated, and the results were compared with those with a matt white surface of reflection factor about 80 per cent. A somewhat unexpected result is that the glazing of the tiles does not make a great difference, except that the glazed brick proves to be somewhat brighter than a similar matt surface near the bottoms of wells, whereas near the top the reverse is the case.



International Illumination Congress 1931

A more complete notice of the arrangements for the above Congress has recently been issued. The meeting will be divided into two parts, the first part consisting of a Congress, which will be held from September 2nd to September 12th, and the second part consisting of meetings of the technical committees of the International Commission on Illumination, from September 13th to September 19th.

The provisional arrangements are as follows:—

LONDON—	
Tuesday, September 1st	Registration and Reception.
Wednesday, September 2nd ...	Visits to places of technical interest and sight-seeing.
Thursday, September 3rd ...	
GLASGOW—	
Friday, September 4th	
Saturday, September 5th ...	
EDINBURGH—	
Sunday, September 6th	
Monday, September 7th	Technical Sessions and visits to places of technical interest.
Tuesday, September 8th	
SHEFFIELD—	
Wednesday, September 9th ...	
Thursday, September 10th ...	
BIRMINGHAM—	
Friday, September 11th	
Saturday, September 12th ...	
Sunday, September 13th ...	Tour by road from Birmingham to Cambridge.
CAMBRIDGE—	
Monday, September 14th, to ...	By the courtesy of the College Council, the Delegates will be accommodated, and the various technical meetings and the Plenary Session of the International Commission on Illumination will be held, in Trinity College.
Saturday, September 19th ...	

Prospective subjects for discussion include the lighting of the home, and of schools, streets, factories, offices, museums, etc., and such specialized matters as aviation lighting and lighthouses, floodlighting, traffic-control lighting, etc.

The President of the Congress is Mr. Clifford C. Paterson, Sir Francis Goodenough is Hon. Treasurer, and the Hon. General Secretary is Col. C. H. S. Evans, who is now conducting operations from the offices of the Illuminating Engineering Society at 32, Victoria Street, London, S.W.1.

The General Council, which is presided over by Lt.-Col. K. Edgcumbe, has received influential support from over 20 Government departments, scientific and technical bodies being represented.

The Congress will be open to:—

(1) *Members*
(including official delegates, representatives of or persons nominated by Governments, public administration and international and national technical bodies). Registration fee, £2.

(2) *Ladies*
accompanying members, who will be registered without a fee.

It is hoped to relieve registered members and their accompanying ladies, attending the Congress from abroad, of a considerable part of the travelling expenses from point to point in Great Britain. Issue of the transactions of the Congress will be made to members free of charge.

All those who hope to attend the International Illumination Congress, 1931, are desired to notify the Honorary General Secretary *as soon as possible;* such notification will be regarded as tentative only, pending formal application for registration at a later date.

This important Congress, which can scarcely be held again in this country for many years, naturally makes a strong appeal to members of such bodies as the Illuminating Engineering Society and the Association of Public Lighting Engineers. But there must be many others throughout the country who could benefit by this unique opportunity of hearing what is happening throughout the world in connection with illumination.

Economy and Efficiency in Industrial Lighting

One of the main features of the work of the Illuminating Engineering Society is that it tends constantly to overflow in new directions. Apart from the papers read at the Society's own meetings, its members are constantly sharing in other gatherings where special aspects of illumination are discussed, so that a continuous process of self-education is going on. An excellent instance of such supplementary effort towards better lighting was afforded by a meeting of the Engineering Section of the first of the Management Research Groups of Great Britain, which the writer had the privilege of attending.

The party, which included representatives of leading industrial firms, had a full day's programme. In the morning addresses were given by Mr. D. R. Wilson (H.M. Deputy Chief Inspector of Factories), who is a Past President of the Illuminating Engineering Society, and by Mr. J. S. Dow (Hon. Secretary of the Illuminating Engineering Society). The papers led to a brief but interesting discussion, after which some time was occupied in inspecting the lighting exhibits in the basement of the Home Office Industrial Museum. Afterwards the party spent a short time in the demonstration rooms of Holophane Ltd., round the corner, subsequently lunching at St. Ermin's Court Restaurant. The afternoon was devoted to visits to offices and factories. The new building of Lloyds Bank Ltd. and Imperial Chemical House both afforded interesting examples of the use of artificial daylight. Later in the afternoon the L.G.O.C. overhaul and repair work at Chiswick were visited, and these proved of considerable interest as an example of modern methods of industrial lighting. This programme, combining addresses and visits, was a most instructive one. If similar functions could be arranged for other research groups the aggregate influence towards better industrial lighting should be very considerable.

Light Extends the Season

Under the above title *Electrical Industries* comments on the practice, adopted for some years past at Blackpool, of providing special illumination along the front in mid-September, with a view to prolonging the season. This year about 300,000 lamps have been employed, and an extra £12,000 was spent on the illuminations. It is considered, however, that the money has been well expended. On the day of switching on, 100 special trains, supplemented by a small army of motor-coaches, bring as many as 200,000 visitors to the town.

Light in Architecture and Decoration

We recently referred to the series of illustrated notes on "architectural-lighting" installations, which have for some time formed a feature of the *Transactions* of the Illuminating Engineering Society (U.S.A.). Over sixty of these descriptions, each occupying a page, now appear in a booklet entitled "Light in Architecture and Decoration." Many of the pictures are interesting, but to our mind the lighting of the San Francisco Stock Exchange is the most spectacular. The roof lighting, by means of diffusing panels, and the concealed lighting of the long frames on which quotations of stocks and shares appear are quite distinctive. The names and addresses of the buildings which figured in this "Lighting Sight-seeing Trip" are published; no doubt the distinction of appearing in this list will encourage some of the firms mentioned to maintain interest in their lighting. The booklet also contains a number of contributions discussing the relation of light to architecture and decorations, which have appeared in past issues of the *Transactions* of the Society.

Annual Reports on Illumination

The Bulletin of the *Société Française des Electriciens* for November contains the series of reports on various aspects of illumination, which have now been a regular feature for several years. M. Jouaste reviews photometry during 1929-30. M. Partridge deals with lighting legislation. Other contributions deal with incandescent lamps, lighthouses and beacons, the lighting of studios, and physiological optics. The legislation referred to is concerned with vehicle lighting. Somewhat strict regulations have been introduced by the *Ministre des Travaux* during recent years. Headlights must in future illuminate the roadway for 100 metres. Motorists, when meeting other cars, must suppress glare without turning out their headlights. Special apparatus embodying the desired features is now being supplied by manufacturers with a stamp of identification. In future the use of apparatus lacking this stamp will be prohibited. Monsieur G. Cabet's contribution on studio lighting mentions the much-discussed question of the relative merits of arcs and incandescent lamps. He is not greatly impressed with the use of "filters" in circuits to eliminate ripples, and attaches chief importance to the use of carbons of good quality, run at a relatively low current density, in order to obtain comparative noiselessness. He admits, however, that the arc is at present indispensable in certain cases; e.g., when very sharp contrasts are desired. The construction of a 10,000-watt incandescent lamp for cinema work is described in detail.

The Lighting of Churches

The most recent issue of *Illuminotechnica*, which of late has contained a number of well-illustrated articles on special phases of lighting, is devoted mainly to church lighting. A general article on this subject by E. Castaldi is illustrated very largely by photographs of British churches. We notice, for example, views showing the lighting of St. Paul's and concealed lighting in churches in Leeds, Bath, Dunstable and elsewhere. A supplementary contribution by G. Cianelli describes in detail the lighting, mainly indirect, of the Church of St. Giovanni, in Laterano (Rome). There are many pleasing illustrations, in none of which is a source of light visible. Especially interesting is the treatment of long arched passages by concealed methods.

An Industrial Lighting Code

In the revised Code of Industrial Lighting, prepared by the Illuminating Engineering Society in the United States, an interesting feature is the division of the matter into three parts, (1) emphasizing the advantages of good illumination, (2) containing recommendations and (3) suggesting minima and rules such as might be adopted by State authorities. The "Levels of Illumination" in (2) cover a considerable variety of processes. A "range of values" for each case is indicated, thus leaving the consumer considerable latitude. It is pointed out that in cases where exceptionally high illuminations are proposed, and where the range may be as much as 4:1 the higher value is only considered necessary at certain specific points, i.e., local illumination supplemented by moderate general illumination is indicated. Values recommended for various operations attain 100 foot-candles in a number of cases, while 15 to 25 is quite usual for the upper limit. The Table of Minimum Values presented in (3) is on a much more moderate level. For general purposes, minima from 0.02 (roadways, etc.) up to 1.0 foot-candle (stairways, passageways, etc.) are suggested; the minimum foot-candles at the work varies from 0.5 for the very roughest work up to 8 foot-candles where observation of minute detail is involved. The contrast between values in (2) and (3) is a timely recognition of the essential difference between what is, in effect, a legal minimum and a working value, based on good practice, which may be recommended in the interests of efficiency. Another comprehensive and more general list of values of illumination has recently been published by the *Association Normande pour prevenir les Accidents du Travail* (Rouen). These values, expressed in lux, relate not only to diverse industrial operations but also to libraries, schools, hospitals, etc. One gathers that 40 to 100 lux (approximately 4 to 10 foot-candles) is considered sufficient for the majority of industrial operations, though there are a few cases (composing rooms, watchmaking, etc.) where as much as 200 lux (20 foot-candles) is recommended. We notice, in passing, that classrooms in schools are considered to need 8 foot-candles, and laboratories 10; also that in cinema theatres a general illumination of the order of 1-10th foot-candle is considered practicable whilst the film is being shown.

Spectacular Lighting in Denmark

Denmark is now to be included amongst the countries that have recently organized lighting demonstrations on a large scale. Spectacular lighting was a feature at the Electrical Exhibition organized in Copenhagen during September 20th to October 1st. According to an account by Dr. Gerard Schmidt, in *Licht und Lampe*, the exhibition attracted many visitors from all over Denmark, and was extended for three days beyond the original date. This illustrated description contains a number of views showing original lighting. The picture of the grounds shows an illuminated "Temple of Light" in the background and illuminated fountains in front. Two other unusual features were the colonnade between large columns, lighted from within, and an ingenious "wall of light," based on indirect methods. The exhibition contained numerous educational items, including a rotating display window, wherein the combination of lighting units with decorative surroundings was effectively illustrated.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

The Lighting of Offices and Public Buildings

(Proceedings at the Meeting of the Illuminating Engineering Society, held at the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C., at 6-30 p.m., on Friday, November 14th, 1930.)

A MEETING of the Illuminating Engineering Society was held in the House of the Royal Society of Arts (18, John Street, Adelphi, London, W.C.), on Friday, November 14th, 1930. Members assembled for light refreshments at 6-30 p.m., and the meeting opened at 7 p.m., when THE PRESIDENT (Lt.-Col. K. Edgcumbe) took the chair.

After the minutes of the last meeting had been taken as read, the HON. SECRETARY announced the names of the following applicants for membership: —

Ordinary Members—

Bristol, A. C. .....Sales Engineer, Messrs. Verity's Ltd., 102A, Sinclair Road, London, W.14.

Goring, H. R. .....Marylebone Electric Installation and Repair Service, 86, George Street, Baker Street, London, W.1.

Hockley, H. R. .....Sales Engineer, Messrs. Chance Bros. & Co. Ltd., Lighthouse Works, Smethwick, Birmingham.

Minchin, L. T. .....Chemist, Gas Light & Coke Co., 29, Belle Vue Road, London, S.W.17.

Reeves, E. L. .....Marylebone Electric Installation and Repair Service, 49, Kingshall Road, Beckenham, Kent.

Tommins, W. .....Electricity Department, Manchester Corporation, Town Hall, Manchester.

Country Members—

Anketell, R. C. .....Illumination Department, Messrs. Philips Lamps (N.Z.) Ltd., Wellington, New Zealand.

Davidson, E. J. .....Manager, Lighting Service Bureau, Irish Free State, Electricity Supply Board, 46, Waterloo Road, Dublin, S.E.6, Ireland.

The names of applicants presented at the last meeting* of the Society were read again, and these gentlemen were formally declared members of the Society.

The PRESIDENT then called upon Mr. J. A. MACINTYRE to read his paper on "The Lighting of Offices and Public Buildings" (see pp. 290–294). The early part of the paper was concerned largely with natural lighting. Various aids to the access of daylight were mentioned, and the idea was thrown out that mirrors placed *inside* a room, so as to reflect downwards light received from outside mirrors, might sometimes prove useful. Reference is also made to the calculation of the available illumination derived from light wells, and to some problems involved in the natural lighting of picture galleries. As regards artificial lighting, the work of the Advisory Committee which reported on the lighting of public buildings in 1930 was quoted. This prescribed a minimum of 2 foot-candles. In the concluding portion of the paper such problems as the use of daylight lamps and the relative merits of general and local illumination lighting were briefly discussed.

In the subsequent discussion of the paper Mr. P. J. WALDRAM, Mr. A. W. BEUTELL, Mr. H. ROBERTSON, Mr. A. BLOK, Mr. H. T. YOUNG, Mr. P. GOOD and Mr. H. LONG took part. Mr. J. A. Macintyre briefly replied to various points raised in the discussion, and a vote of thanks to the author terminated the proceedings.

* *The Illuminating Engineer*, November, 1930, p. 263.

FORTHCOMING EVENTS.

Before the meeting broke up the HON. SECRETARY briefly mentioned several forthcoming events, such as the visit to Gamages new West End Store (November 18th); the first Cantor Lecture on "Modern Domestic Scientific Appliances," by Prof. Charles R. Darling, at the Royal Society of Arts (November 24th); and the discussion on "Modern Design in Electric Lighting."

Attention was also drawn to the following two events in December: —

A visit to the L.G.O. Repair Works (Chiswick) has been arranged to take place on Friday, December 12th, between 4 and 5 p.m. Particulars of this visit will be circulated to members in due course.

A meeting of the Illuminating Engineering Society will be held, by the courtesy of Messrs. Holophane Ltd., in the lecture theatre of the company at Elverton Street, Westminster, at 6-30 p.m., on Friday, December 12th, when a paper reviewing the Application of Glass for the Transmission of Invisible (Infra-red and Ultra-violet) Rays, accompanied by experiments, will be presented by Dr. S. English.

PROBLEMS IN ILLUMINATING ENGINEERING.

PRIZE OFFERED.

We take this opportunity of again reminding readers of the meeting of the Illuminating Engineering Society, to be devoted to a series of **Problems in Illuminating Engineering and their Solution,** in February next.

Contributions for presentation at this meeting are now invited. Each item should occupy about 10 minutes, and any topic of interest may be discussed—including problems that have so far defied solution, though methods of overcoming difficulties should be indicated where possible.

In order to encourage effort in this direction, "**The Illuminating Engineer**" is offering a **Prize of One Guinea** for the best account of a "Problem" that reaches the Editor, at 32, Victoria Street, London, S.W.1, previous to January 10th, 1931. Contributions, which may be accompanied by illustrations, should not occupy more than 1,000 words. The envelope containing the contribution should bear the word "Problem" in the left-hand lower corner. It is understood that the decision of the Editor, or his nominee, in making the award, is final, and that any contribution entered in this competition will be available for presentation at the meeting of the Society in February next.

The Lighting of Offices and Public Buildings

By J. A. MACINTYRE

(*Paper read at the Meeting of the Illuminating Engineering Society, held in the House of the Royal Society of Arts, 18, John Street, Adelphi, London, W.C., at 6-30 p.m. on Friday, November 14th, 1930.*)

As offices and most public buildings are occupied for longer periods during daylight hours than in the evening and many people have to spend a greater part of these hours in such buildings than elsewhere, consideration will first be given to natural lighting.

The outer windows of a block of offices are nearly always prominent features in the elevation, and consequently restrictions are imposed on their design, both as regards size and position, which may affect their utility as transmitters or secondary sources of daylight. The limits of these restrictions must necessarily be decided by the architect, and there are so many cases where interference by outside cornices and other heavy ornamental stonework on front and side elevations cut off so much light that it is evident that, either he has not given the consideration to natural lighting which is essential to good design, or he has deliberately sacrificed utility in his planning to facilitate the creation of pleasing elevations. He is tempted to do this knowing that his building will be judged by the majority, and possibly by his clients themselves, more from that aspect than from the plan. In fact the architect who made fenestration the main factor in his design in a competition for such a building would have little chance of success, and illuminating engineers must recognize this fact before effective assistance can be given on daylight problems, as liberal compromise is likely to be necessary in all cases.

The education of an architect does not generally include any intensive study of illumination, and his knowledge of the subject may be confined to a few empirical rules giving proportional dimensions of windows and rooms. On the other hand very few illuminating engineers know much about architecture, and many of them are so engrossed in the design of artificial lighting units and systems that they lose sight of the daylight problem, and probably would not consider it a retrograde step if architects decided that the whole of a site should be built over, where land values are high, so that in the majority of the rooms artificial light only would be available. It may be contended that this aspect of illumination is not peculiar to offices and public buildings, but it is probably more important in relation to these than to any others, as offices in large towns are generally situated in areas which are closely built over and where land is expensive.

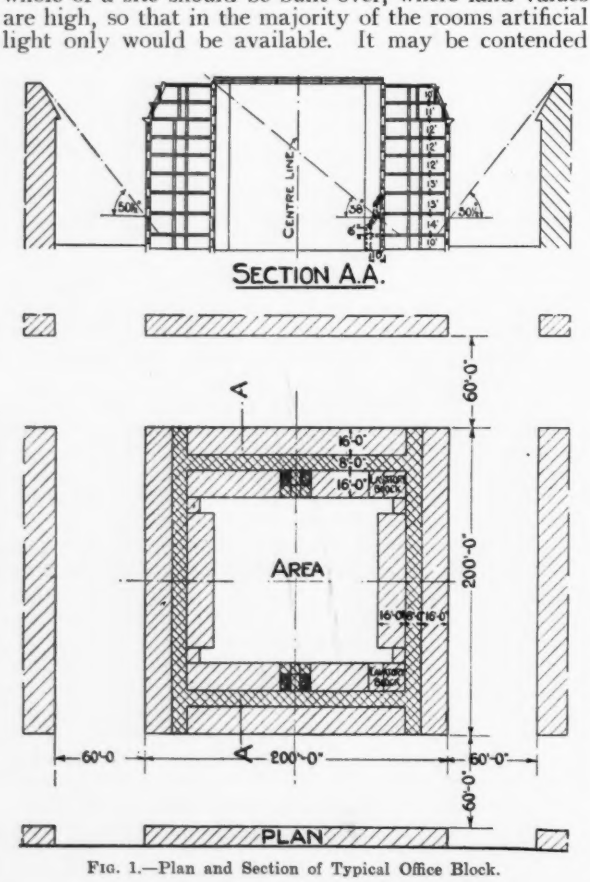


FIG. 1.—Plan and Section of Typical Office Block.

In a paper prepared by J. G. West for the International Illumination Congress (1928), on "Daylight Illumination in Respect to a Typical Building Site in a Large Town," it was pointed out that, on an isolated site 200 ft. square surrounded on all four sides by streets 60 ft. wide, reasonable building development only gave 17,000 square ft. of office working area per floor out of the total 40,000 square ft. area of the site. Of the remainder, 11,000 square ft. was taken up in corridors and stairs and the light well was 12,000 square ft. in area. Fig. 1 is a plan and elevation of the development referred to.

The parapets of surrounding buildings were assumed to be 80 ft. high, and under these conditions only the offices on the three upper floors facing the streets and on the five upper floors facing the light well could be said to be lit adequately throughout the whole of their area at desk level. Of the total area at this level on all floors about 26 per cent. would not get adequate daylight. The total office area on all floors is 133,000 square ft., of which less than 100,000 square ft. is adequately lit. This figure could have been increased slightly by making the light well smaller, but at the same time the area inadequately lit would have been increased in greater proportion.

The depth of rooms selected by Mr. West was 16 ft., and the desk area on the six lower floors which gets direct sky light reaches a maximum when this depth is about 26 ft. The well would then be 80 ft. wide instead of 120 ft., and the desk area getting inadequate light would be nearly 50 per cent. of the total, a condition few clients would accept on such a site.

It will be seen, therefore, that even when a client is prepared to, or perhaps one might say is forced to, sacrifice more than one-third of his site as light-well area and have his corridors in the darker portion of the building, as was assumed in this case, he is still left with nearly a third of his office accommodation which must have artificial light at all hours if it is to be used effectively.

It might be contended that the light-well area is wanted for ventilation in any case, but it would be an easy matter to get all the air required through a very much smaller well.

This case represents really good practice, and we all know of many office buildings in which the daylight conditions are very much worse, so it can be taken for granted that legislation is not likely to improve on the figures quoted, at least for many years to come.

There are one or two ways in which improvement is possible without introducing any structural difficulties. The first and probably most obvious of these is by the use of bulkhead lights on the lower floors, but few architects would adopt these in this class of building, and it must be admitted that there is something not quite pleasing in a room lit in this way.

The area of the two lower floors facing the light well which is adequately lit could be increased without affecting the lighting of any other part of the building by projecting the rooms into the light well and sloping the windows as is indicated by dotted lines in the elevation in Fig. 1.

By projecting the ground and first floor rooms into the well in this way, the desk-level area in these rooms facing the light well, which gets adequate light, is nearly doubled, and with this treatment, adhering to the 16-ft. depth, it would actually be better from the point of view of illumination to make the well narrower and widen the street.

A third method and one which seems to be more deserving of attention than it gets is by the use of reflec-

tion. It should be explained that in the above analysis it has been assumed that all parts of the working planes in the rooms which get light direct from the sky are adequately lit and vice versa. We know by long experience that this will be so in such a building where no special provision is made to alter the direction of light by special devices, and it is from this aspect that illuminating engineers may be able to give valuable help. Apart from glazed bricks and tiles, there might be said to be only two forms of reflectors in common use, namely, prismatic glass and the fluted mirror, generally placed hard up on the window and set to throw light on the ceiling. Both are reasonably effective, but prismatic glass especially gets dirty quickly and its non-transparency accentuates the effect produced by the dirty surfaces. Usually the mirrors cannot be set to throw light directly on the working plane without producing glare when the sky is bright. In two cases tried recently secondary mirrors were placed inside the room set to throw the light reflected from the outside mirror on to the tables, and these proved satisfactory, but the appearance of the mirrors themselves was rather objectionable. They were regarded in the cases purely as useful fittings, and no effort was made to fit them in positions where they would not be offensive. Had the architect who designed the building taken the trouble to work out the daylight factors of these particular rooms he would have realized what was wanted, and the mirrors might have been an integral part of his structure. There seems to be no fundamental reason that a mirror at inside cornice level or even on a ceiling need be more offensive than an overmantel, if the interior plaster work is designed to take it, nor is there any necessity for the outside reflector being hard up on the window. It is hardly necessary for me to say that I do not advocate the use of reflectors, even when properly designed parts of the structure, as being equal to direct skylighting, but they appear to be the best substitute and could be used frequently to increase the value of a room with more satisfactory results than could be obtained from artificial-lighting fittings.

An interesting problem in daylight lighting which appears to have been solved satisfactorily by the use of reflectors arose this year at the National Portrait Gallery, Trafalgar Square. The picture showing a group of our statesmen who were in office during the Great War, painted by the late Sir James Guthrie and presented to the nation, had to be housed in a room in which the outside obstruction was such that the cut-off of the sky struck diagonally across the wall on which the picture had to be hung. Sir James Guthrie would not agree to have artificial illumination only, nor that the darker side of the picture could be so dealt with, even when assured that the daylight colour could be matched nearly enough, and that this was the more direct and probably the more economical method. He actually refused to agree to the picture being hung in the room at all unless the daylight was made satisfactory, but on the other hand offered to meet the cost of experiments with reflectors up to a very generous figure, as he agreed that the room in all other respects was a suitable home for his work.

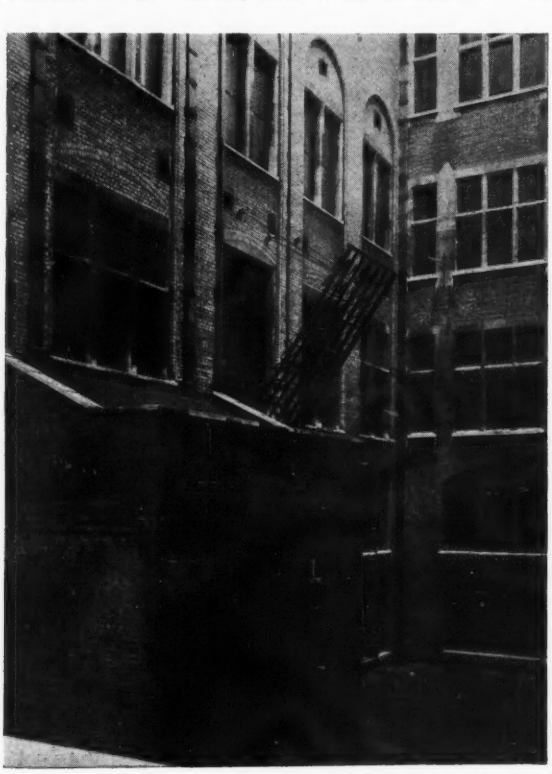


FIG. 2.—External view of Reflector to improve access of daylight.

The form of external reflector used, shown in Fig. 2, consisted of 50 mirrors (12 ins. square) mounted in a steel frame, and each on an independent ball joint so that it could be set to throw light on any part of the wall desired. This was placed just outside the window adjacent to the wall on which the picture is hung, and in addition eight internal mirrors about 3 ft. by 2 ft. were fitted inside the room on the opposite wall, set to catch the light from some sections of the outside reflector and throw it back on the picture, Sir James desiring this directional effect as being suited to the colouring. Fortunately the scheme was sufficiently advanced before his death for a full demonstration to be given, and he expressed himself as satisfied with the results, though he did not see the actual picture in position.

Fig. 3 is a photograph of the picture showing how it is lit without the reflectors, and Fig. 4 shows it with these in service. The window itself and the internal reflectors, as well as the artificial lighting fittings, are shielded to a certain extent from anyone viewing the picture from normal position by means of projecting walls terminating in a flat arch at ceiling level to form an alcove.

The times of exposure for these two photographs were exactly the same, namely, 2½ minutes, the plates used being Imperial Ortho, non-filter, speed 250 H. & D. Naturally the eye does not detect the minor contrasts shown up so clearly by the camera, and the lighting of the picture, as indicated in Fig. 4, was actually accepted by the Gallery authorities as being satisfactory, though actually the intensity is still too high in the lower left-hand corner.

Fig. 3 illustrates very clearly how rapidly the intensity falls off across the line where the sky is just visible, especially in a room where the reflection factors are low. The walls in this case are all dark, and there is a brick wall opposite.

Artificial lighting is by means of four wide-angle flood lanterns, and a special feature is that the two of these remote from the window are to be controlled by means of a photo-electric cell, so that in very dull weather, when there is not enough natural light to deal with the whole area, they are automatically switched on. This arrangement is being designed at the National Physical Laboratory.

The light from these lanterns has to be corrected, as they are used in conjunction with daylight, and it has been found that sufficient correction is given by a gelatine filter, which is just faintly blue. Transmission efficiencies of this filter have not been measured yet, but this will be done on the actual glasses when these are made to match, and I expect a fairly high figure, indicating that the degree of correction for a service of this description need not be very great. When it has been decided what daylight is to be accepted as the standard for colour matching, it would be of interest to illuminate half a picture of this kind with it, and try different filters on the other half to ascertain through what range the ordinary observer is unable to detect any difference. With a judicious selection of pictures such a test should help to fix an efficiency for rough artificial-daylight units which are not required for colour matching.

The fact that all the mirrors, including those inside, are on ball joints makes the system extremely flexible; light can be intensified or the reverse on any part of the picture desired, and when each mirror is set to the

required angle it is made fast very simply by the tightening-up of one nut. The original design of the scheme included sprays for cleaning the outside mirrors, but these are easily reached by hand and the sprays may not be fitted.

To give further control of the light it was intended to fit vertical slats in the window, each 6 ins. wide in the form of a louvred shutter. These slats were to be made of opal glass, but as the fittings required were all special an economical price could not be obtained, so it was decided to postpone supplying them.

Though this is a very special case and such an elaborate arrangement would be too expensive for normal use it does illustrate what can be done, and in many common cases a very much simpler scheme might be equally effective.

It has been demonstrated fairly conclusively that daylight will be adequate for ordinary clerical work at positions where the daylight factor is not less than 0.2 per cent., that is to say, except in very dull weather

FIG. 3.—Daylight Illumination of Picture without Reflector.

FIG. 4.—Daylight Illumination of Picture with Reflector in service.

artificial light will not have to be resorted to in such positions. It is clear, therefore, that the amount of light falling on a site on an average day is more than 10 times that required to illuminate every floor of a skyscraper if it could be distributed effectively. While we cannot hope for anything like an effective efficiency of even 10 per cent., improvement is possible, and the first step towards this is to get architects to have a better realization of the wastage and get them sufficiently interested to develop methods of improvement.

Work has been done recently at the National Physical Laboratory which should enable us to get the relation between the daylight factor at any point in a light well and the reflection factor of the wall surfaces, and research work on the illumination in deep rooms is also in hand. There are obvious difficulties in simplifying the calculations, and it is clear from past experience that, unless some method is developed by which approximations to the daylight factors can be estimated without elaborate calculation, architects will not take the trouble to understand it, certainly will not use it, and conditions will remain as they are.

Many architects shamelessly place heavy ornaments where they act as serious obstructions to rooms and thereby create a demand for artificial light which should not be necessary, and it seems inconceivable that this would be done to the extent it is if the daylight factors in the rooms affected had been worked out in the planning stage. In fact, if this were done on all building plans improvements would very soon be introduced, either on the lines suggested above or otherwise. I have said that illumination will not be accepted as the main factor in a design, but it seems reasonable to assume that, in such a competition as was referred to, if the judges or scrutineers had the daylight figures it would help them in one aspect of their task which generally must be a most difficult one.

Messrs. Waldram's method of estimating daylight factors is quite well known and is comparatively simple and accurate, but the work involved in dealing with even a straightforward scheme of any size is very heavy. Consequently the method is not being used to any great extent to forecast conditions on plans, though the frequency with which it is resorted to in cases of dispute is sufficient evidence of its merit. Other methods of treating the problem have been published, but generally they are more complicated and involve more graphical work, so it would seem that the only hope of obtaining simplicity and speed might be by a certain sacrifice of accuracy.

The daylighting efficiency of any particular room might be defined as the ratio of the area of the working plane over which the daylight factor is 0.2 per cent. and greater, and the whole area of the working plane in the room. On this definition, average rooms in which the sky is visible from the parts of the working plane in the corners remote from the windows would have an efficiency of nearly 100 per cent., the only part of the plane inadequately lit probably being that in the corners adjacent to the windows.. To estimate the efficiency in other rooms where the sky cut-off intersects the working plane, taking reflection factors of obstruction into consideration and working from first principles in each individual case, is almost impracticable from the point of view of time involved, and it is hoped that when the research work has been completed at the National Physical Laboratory some quicker method of solution will be developed. If some such definition as I have given were accepted generally for efficiency of fenestration design, it might be possible to prepare sets of tables of efficiencies in individual rooms which would include many common cases. The number of variables, including window dimensions, depths of rooms and dimensions and distances of outside obstruction, would render the task difficult, but it might be found that ordinary building practice is standardized sufficiently to make it possible to prepare data which would cover average cases and which would not be too unwieldy.

Architects have a marked aversion to calculations which are outside the scope of simple arithmetic, and tables are particularly attractive to them, so much so that they will even deal with their own steelwork problems when they can get the data necessary from a maker's list of sections.

The natural lighting of picture galleries has been dealt with fully by Dr. Walsh in Technical Paper No. 6

of the Illumination Research Committee, published by H.M. Stationery Office, and this describes the one-sided Gallery No. XIII, at Millbank, in which the design suggested by the National Physical Laboratory was adopted, and in which the lighting of the pictures is practically perfect. One would think that for a picture gallery the major essential in the design was that the pictures should be illuminated to be seen to the greatest advantage, and, while the Trustees of the Gallery of British Art and those also of the National Gallery both admit that the detail of the pictures in this one-sided Gallery is seen to greater advantage than in any other, they do not accept the design as satisfactory, and in galleries which have been built later the section has been altered; they are two-sided and the lighting is not nearly so good.

The main objections to Gallery XIII are stated to be:—

(1) That it is extravagant in space, the pictures being hung on one side only. This must be so with the design, and it was pointed out by Dr. Walsh that the ratio of hanging areas between two-sided and one-sided galleries on the same site would be about 100 to 60.

(2) That the interior of the gallery generally is not so pleasing as one of symmetrical design. Coupled with this it is contended that pictures can be so hung on the walls of most two-sided galleries of reasonable design as to be seen quite well, there being at least one position at which reflections in the glass are not troublesome. Architects incline to the same opinion, and even the top-side-lit gallery suggested by Seager is not likely to find favour to any great extent meantime, there being a tendency to revert to an older form with cross lighting in which the intensity of light on the floor will be greater than that on the walls.

However, we may comfort ourselves with the fact that the building of Gallery XIII has not been wasted effort by any means. Though not being adopted as general standard design as we should wish and as the illumination results would justify, it is accepted and shown as the last word in the illumination of pictures. Greater familiarity with its unusual features may lead to these becoming less objectionable, and it is quite probable that in a few years architects will be adopting the form of fenestration more generally, without necessarily having the other constructional features the same.

It would be of great advantage to have for similar demonstration a multi-storey block of offices in a crowded area designed with the same objective, namely, to have the natural illumination on the working planes in the rooms as nearly perfect as constructional difficulties and surrounding obstructions will permit. Such a building might not be regarded as a perfect effort from the architect's point of view, but there would be many features about it which architects would copy with advantage.

The artificial lighting of the National Gallery and of the Gallery of British Art is under consideration now, and it is expected that both these buildings will be equipped within the next two years so that they can be opened to the public in the evening if required. The lighting of Gallery XIII obviously presents no difficulty, and experiments with floodlights, 8 ft. apart, indicated that almost uniform intensity could be obtained over the whole of the hanging area, the variation being of the order of 10 per cent. Uniformity of this order is quite unnecessary and is actually regarded in some quarters as a disadvantage, the claim being that we are accustomed to enormous variations in natural lighting and noticeable variations in artificial can be adopted to improve the general effect.

The two-sided galleries present more difficulty, and in some of these we may have to fall back on general lighting through the roof lights or with bowls or spheres to brighten the rooms generally and light up the architectural features as well as the pictures. There are three other methods under trial, namely, by flood lanterns at high level, by reflecting troughs, hung usually lower than the lanterns would be, and by very high power units in the ceiling shaded to light the walls only. The troughs receive the most favour, but in some galleries their appearance is decidedly objectionable, especially by day.

It will be realized that even with perfect lighting, either natural or artificial, in a two-sided gallery there must always be cross reflection from wall to wall, and the gilt frames show as bright lines in the glazed pictures opposite, specially conspicuous when these have a dark background. Neither abolishing the gilt frames nor tilting the pictures is regarded with very great favour by the keepers of the galleries: they would rather tolerate the reflection.

As regards the colour of artificial light for pictures the average opinion of artists and others who are responsible for galleries and exhibitions appears to be in a state of transition. A great many pictures, probably most, show up quite as well in the light from a gasfilled lamp as in daylight. The artificial daylight adopted in the Leeds Gallery some years ago was accepted as an improvement, but attempts to correct to about the same amount in the National Portrait Gallery, London, and in the National Gallery, Edinburgh, led to complaints that the light was "cold." In Edinburgh a system cutting out very much less of the red was accepted, and opinion at present is that only a very small amount of correction is wanted. In one case the "sunshine" effect of gasfilled lamps shining on a diffusing lay-light during daylight hours was accepted as an improvement, until it was demonstrated in the interests of economy that the same effect could be obtained with sections of yellow glass in the main roof light.

The intensity of artificial light on most pictures need not be more than 4 foot-candles, and many light water colours show up quite well with 2 foot-candles. There is a tendency to advocate higher intensities, and, while these might be required for intensive examination of detail, 4 foot-candles is quite enough to enable one to realize the merits and appreciate the beauties of the artist's work. The danger of exposing valuable pictures to high light intensities is obvious, and although it may be contended that in most galleries it is during daylight hours that the damage will be done, we have no evidence which would justify us in stating that some of the pigments will not still be fugitive to artificial light. From this aspect the one-sided Gallery XIII has a great advantage in that the picture wall being the brightest part of the room the actual intensity need not be so great for equal appreciation as in a gallery where the floor is as well or better lit than the walls. Parts of certain Italian primitive pictures are under investigation now to ascertain if any of the colours left are still fugitive, and if this is found to be so it may have a reaction on gallery design.

For the artificial lighting of offices where special effects are not required for advertising purposes nor special fittings to supplement the decorations of the rooms, satisfactory results are easiest to attain when a combination of general and individual lighting is installed. The intensity recommended for ordinary clerical work by an Advisory Committee on the Lighting of Public Buildings in a report issued in 1920 was an average of 3 foot-candles at mid-period of decoration and lamp life, a minimum average of 2.5 foot-candles, and that at no point on the working plane should the minimum be less than 2 foot-candles. There is no evidence either from the point of view of health or output that appears to justify higher figures than these.

Technical Paper No. 10 of the Illumination Research Committee deals with the effect of distribution and colour on the suitability of lighting for clerical work, and it is stated that, although under special test at the National Physical Laboratory subjects declared a preference for artificial daylight, in public offices generally this preference was definite only where there is mixing of natural and artificial light. It is only under such conditions, therefore, or where colour contrasts are important, that the use of the lower efficiency artificial daylight units would appear to be justified. Medical evidence is not definite on the comparison up to the present.

An interesting series of trials was conducted in the Ordnance Survey Offices, Southampton, about two years ago. The selection of the fitting to be installed for the

drawing tables was left to the draughtsmen themselves, and they were given as many samples and different kinds of lamps as were readily available. They did not all choose the same, and this could hardly be expected, but the majority asked for individual lighting with simple pendants having deep conical earthenware shades and 60-watt blue lamps, the earthenware shades being chosen specially in preference to translucent opal. Enamelled iron or cardboard shades would probably have done as well. Later there was a complaint that owing to specular reflection from the shade a troublesome image of the lamp filament was thrown on the board, but this was easily eliminated by having a mat interior.

FIG. 5.—A typical Drawing Office.

In a similar test in an engineering drawing office in London ordinary clear lamps were chosen with iron shades as shown in Fig. 5. In this figure it will be seen that the pendant runs the length of the board on a piece of ordinary H section curtain rail fixed on the ceiling. A few general lights are also provided to brighten up the room.

Typists almost invariably call for individual lighting, and Fig. 6 shows a room so equipped. As is often the case in such rooms, the tables are so close together and there is such a forest of pendants that general lighting has not been installed.

A difficulty with both clerks' and typists' rooms, and to a less extent in drawing offices where massed staff is employed, is that the tables are rarely in the same positions for more than a few months at a time, otherwise more table standards with floor plugs might be used. It is impossible to keep ceiling roses correctly placed, and flexible ceiling extensions have to be fitted, which, in addition to forming rather an untidy network, causes rapid blackening of the surface.

This would not occur with general lighting, and in a new office it is really easier to design a general scheme than attempt to ascertain what the positions of the tables are likely to be, so that each can be lit separately. The small rooms are easily dealt with either way. In the large rooms the occupiers have very definite opinions as to the placing of their tables; some of them want draught screens—a want that they could not foresee—and there are generally a few high file racks, and possibly even partitions, which were not contemplated prior to occupation, so that ceiling extensions have to be adopted in spite of their disadvantages.

The history of the installation at the Ministry of Pensions Building, Acton, offers a good example of the difficulties encountered in lighting offices where the staff is fluid to a certain extent. This was first designed about 1921 for general lighting with semi-indirect units consisting of 14-in. bowls, with 150-watt lamps spaced about 15 ft. apart. The bowls collected dust quicker than was anticipated, cleaning became an expensive item, and also the intensity drop due to dirtying of the ceilings was underestimated, or perhaps the cleaning was less effective than it should have been. In addition the usual difficulties with high racks and draught screens were encountered, and in some of the smaller rooms individual lights had to be given shortly after occupation. Later it was decided to make the lighting in all

FIG. 6.—Typical Mass Typing Room with local lighting.

rooms more independent of the ceiling decorations, and the open bowls are gradually being replaced by closed fittings with the same size lamps, but the spacing is being reduced to an average of about 12 ft. A great deal of trouble and a considerable number of complaints would have been avoided had a few general lights only been given and individual lamps provided for the tables.

Banks and insurance offices present rather a different problem, as the arrangements of occupation are more stable, and general lighting is not so likely to be made ineffective by racks and screens, the positions of which were not known in the planning stages. The selection of fittings is largely a matter of taste and knowing a few to avoid, but it is advisable to select these which give the required polar curve by themselves and not depend on reflection from the ceiling, unless regular cleaning is sure to be maintained.

A few years ago there were a few semi-commercial fittings on the market with bowls which were nearly opaque, but most modern glassware is fairly good, though a specification which would lead to better standardization is badly wanted.

The higher illumination intensities now called for in museums, and similar buildings where exhibits are shown in cases, present a difficulty which is not generally realized. Indirect lighting is usually out of the question on account of cost and unsuitability of the building, and the use of large units results in shadows which make proper appreciation of the exhibits impossible. The showcases in many museum rooms are by no means permanent fixtures, the nature and position of exhibits are being changed constantly, and the result is that forests of 100-watt and 200-watt fittings have gradually sprung up which make the interior of the building look more like a fireworks display than a well-lighted room. The difficulty can only be dealt with by ascertaining which of the showcases are likely to be reasonably permanent, lighting the interior of these specially, and dealing with the remainder of the floor area with medium-sized units. As in the case of the Acton building, it is surprising how rapidly such installations get out of date.

(The author concluded by showing a few slides illustrating artificial-daylight panels and special fittings. A full account of the discussion will appear in our next issue.—ED.)

Illuminating Engineering: What It Is and What It May Become

(Proceedings at a Special Meeting held in Manchester on October 22nd, 1930.)

A SPECIAL meeting of the Society was held at 4, Fountain Street, Manchester, on October 22nd, when an address was delivered by Mr. J. S. Dow.

Dr. JOHN W. T. WALSH (Past President of the Illuminating Engineering Society) took the chair at 7 p.m. and briefly introduced the lecturer, recalling that this was the second occasion on which the Society had organized a meeting in Manchester.

EARLY EXPERIENCES.

Mr. J. S. DOW explained that he had been asked to give an address on some general subject, and he thought it might be interesting to review the progress of the illuminating engineering movement since its inception in this country, 22 years ago. At that time there were few people closely interested in the applications of light. With the exception of the pioneering instrument developed by Mr. A. P. Trotter there were no portable illumination photometers. Few manufacturers of lighting fittings published polar curves or other engineering data. It was only occasionally that methods of *using* light and the benefits of good illumination were considered. Discussions were not infrequently confined to speculations as to the relative cost of gas and electricity—indeed, illuminating engineering still suffered to-day from the impression, stamped on the mind of the mind of the public in those early days, that lighting was esentially a matter in which one should economize!

Mr. Dow recalled his oft-quoted experience, when he looked up "illumination" in the encyclopædia and was rewarded by the reference "Illumination—see Fireworks"! Twenty years ago illumination was a little-used term, and "illuminating engineering" was quite new. He ought, he supposed, to give a definition of the term. Perhaps as good as any was "the application of light in the service of mankind." This broad conception naturally meant that both artificial lighting by all available methods, and also natural lighting, must be studied, and that the help of both user and producer must be sought in studying lighting problems. The Society included in its ranks not only experts connected with both gas and electric lighting, and lighting specialists, but many users of light and professional men; doctors, oculists, architects, teachers, inspectors of factories—all could contribute to the general knowledge of what constituted good lighting.

THE HUMAN ELEMENT.

Illuminating engineering differed from most other branches of engineering—mechanical engineering for example—in that the human element played a much more vital part. The man who made use of light in his home, or in a school, shop, factory or office could learn by experience and not infrequently developed views of his own which were entitled to respect. Illuminating engineering included the whole chain of operations from the generation of the gas or electricity and the lamp that furnishes the light to the ultimate impression on the human eye, thence conveyed to the human brain. It was that final impression that one sought to capture and that decided whether an installation was a satisfactory one or the reverse.

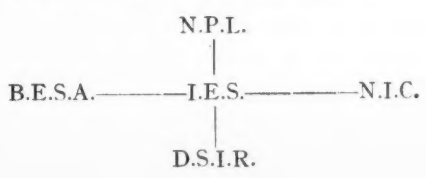
Illuminating engineering was a new subject. Those associated with the movement had had to teach themselves. The work had consisted and would continue to consist partly in investigation and experiment, and partly in educational effort—making known the useful conclusions that had been formed. One found that certain conclusions interested special sections of people. Hence it was a usual practice of the Society to arrange joint meetings with other bodies, thus continually extending the circle of people interested in the cause of better lighting.

Sciences in general passed through several distinct stages. In the initial stage people were occupied in observing elementary facts and phenomena. Later came the period of measurement and deduction of laws, and finally the application of knowledge gained. It was natural that the first 10 years of the illuminating engineering movement should be occupied mainly in developing methods of measuring light, in studying the distribution of light from fittings, and in estimating the amount absorbed or reflected or transmitted by various appliances. Thus initially it became a somewhat severely technical subject; one was preoccupied with the work of measuring illumination, determining polar curves, judging efficiency and getting out various "engineering data." At that time the subject was so new that people had the haziest ideas how much light was actually used in various classes of buildings, and what proportion of the original light was furnished by the fitting. All this experience had to be acquired. Moreover, artificial light was still relatively meagre and expensive, so that naturally one's first consideration was how to make the best use of it without undue waste by absorption. Much, therefore, was heard of the "efficiency" in the sense of the proportion of the original light usefully employed.

LIGHTING AS AN ART.

At the present time, though, naturally, scientific application of light was as important as ever, one was becoming more conscious of the possibilities of lighting as an *art*. Recent advances and discoveries had cheapened the cost of light materially. Artificial illumination was relatively more abundant; also, as a result of sustained educational effort, people had a better sense of proportion in regard to expense. They were more disposed to recognize that poor lighting was uneconomical whatever they paid for it and that, in some cases, the benefits of good lighting were so great that the money spent on it was of relatively small importance. In other words, "the effect" was considered more important than "efficiency." This applied particularly to trades in which light served as a selling force—shops, restaurants and places of entertainment. (In passing, Mr. Dow recalled the remark made at a recent meeting of the Society that the consumption of electricity by the huge canopy of a single store in Paris was as great as the entire lighting load of certain country towns, such as Horsham and Windsor.)

In the next section of his address Mr. Dow passed on to the machinery for studying illumination in this country, which he thought was in some ways more perfectly organized than that available elsewhere. Originally the Illuminating Engineering Society had been almost the sole body interested. But other organizations had developed, such as the National Illumination Committee, with many committees acting under it and linked to the International Illumination Commission; the British Engineering Standards Association, which was responsible for standardization in illuminating engineering; and the Illumination Research Committee of the Department of Scientific and Industrial Research, which was occupied with special experiments and investigation, and had also a number of sub-committees. Finally, there was the National Physical Society, where much of the actual experimenting was done. The amount of valuable work done by those who served, in an honorary capacity, on these various committees was very considerable; many members of the Illuminating Engineering Society served in this way. The whole organization was such that there was no overlapping of effort—and yet each committee was kept broadly in touch with what others were doing. The nature of the organization, Mr. Dow suggested, might be illustrated by the accompanying diagram.



STANDARDIZATION IN ILLUMINATING ENGINEERING.

It was significant that already quite a number of aspects of illumination had been found ripe for standardization. Amongst others, British Standard Specifications dealing with portable photometers, street-lighting and lighting fittings had been issued.

It should be understood that there was in this country scarcely any legislation dealing directly with lighting. This did not necessarily mean that lighting was neglected by the authorities. It was, rather, a result of the national instinct to avoid the making of laws where quietly persuasive methods would be equally effective—and at least only to make laws when it was certain that they would receive public support and would be actually carried into effect. In some other countries there was much more legislation—but one suspected that many laws and ordinances became dead letters. The position in regard to factory lighting illustrated British methods. At the present moment there was not even any specific requirement of adequate lighting in the Factory Act, though it was hoped that this would be inserted before very long. Yet actually the Home Office Factory Department took a very deep interest in industrial lighting, and had organized many conferences with joint industrial councils on this subject. There could be no doubt whatever that they had done a great deal to create a sympathetic interest in better factory lighting and that their influence had been largely responsible for the improvements of recent years.

Mr. Dow also referred briefly to the lighting of schools and streets as other fields where legislative action might be desirable. As education was compulsory, there was an obligation to see that schools were properly lighted. Exercise of central authority might also become necessary in such cases as public lighting, where subdivision of responsibility had drawbacks and national treatment was necessary.

ESSENTIALS OF GOOD LIGHTING.

In the next section of his address Mr. Dow briefly summarized the essentials of good lighting, such as absence of glare, sufficient illumination, and avoidance of inconvenient shadows. He referred to the presence of unscreened lamps amongst the goods of show windows, between the scholars and a blackboard, or between the congregation and the preacher, as illustrations of glare. He discussed at some length the difficulty of eliminating glare from motor-car headlights and in lamps used for public lighting, and he explained how the adoption of a suitable "angle of cut-off" for reflectors helped to minimize glare in the factory. Reference was also made to instances of "reflected glare," e.g., in the case of silverware, newly cast type, writing with copying-ink pencil on flimsy paper, or imperfectly mat blackboards in schoolrooms.

Dealing with "sufficiency of illumination" he pointed out that much depended on the function of light. Very high illuminations could be used in shop windows and elsewhere where a spectacular effect and display were desired. The problem of determining the degree of illumination necessary for various industrial processes was a complex one. Allusion was made to the tests made by the D.S.I.R. on the lighting of printing works, and to Dr. Ives's experiments in post offices, both showing how improved lighting might result in better output or quality of work. On the other hand a clear distinction should be drawn between legal minima or minima recommended in the interests of employees (i.e., to avoid possibility of danger or injury) and values expedient in relation to efficiency. A report of the Home Office Departmental Committee had suggested minima of 3 foot-candles for fine work and 5 foot-candles for very fine work; these values might be, and actually were, often exceeded by progressive manufacturers on economic grounds.

In the concluding section of his address Mr. Dow pointed out the broadening of outlook that had caused certain controversies to lose their acuteness. People now seldom argued much about the relative merits of direct and indirect lighting; it was better understood when either method had advantages, and at the present time both were often used in combination. Similarly, the relative advantages of direct and local and general lighting (likewise often used in combination) had been more fully explored. The author pointed out that there was an exceptional opportunity for good local lighting, supplemented by moderate general illumination, in those trades involving the use of very dark material.

ARCHITECTURAL LIGHTING.

The development of novel and spectacular lighting effects, such as those on view at the International Exhibition in Barcelona last year, was mentioned as an illustration of the possibilities of artificial lighting as an "art." Mr. Dow referred to the so-called "architectural lighting" and to floodlighting. He pointed out how the provision of artificial light was becoming an important factor in determining the design of modern buildings. In dealing with lighting as an "art" the co-operation of the architect was of vital importance; if his interest could be aroused much could be done by the aid of floodlighting to render cities beautiful by night.

After showing a series of slides illustrating points mentioned in the address, Mr. Dow remarked that it was scarcely possible to set a limit to the future development of illuminating engineering. Knowledge was becoming more and more widely dispersed; one found already specialists in certain fields of lighting. He, himself, pictured the Illuminating Engineering Society as continually taking in new interests and widening the circle of its supporters, and continuing to cater for both users and producers, though ultimately an inner circle of those who might fitly be described as fully-qualified illuminating engineers might be formed.

Finally, Mr. Dow briefly alluded to the possibility of a local section of the Society being formed in the North-West Area. This was only one, amongst several localities, where a desire for local effort had been expressed. He hoped that those present would take the opportunity of giving their impressions on this project.

Discussion

THE CHAIRMAN (Dr. J. W. T. Walsh) said he was sure that all present would agree that Mr. Dow had given a most interesting address. Doubtless there would be many points therein which they would like to discuss. He would also like to hear their views on the point mentioned by Mr. Dow in his concluding remarks—the possibility of a local section being formed in the North-West Area. For some time it had been felt that the Society should extend its sphere of influence. Whilst members residing in Manchester were always welcome at meetings in London, one could hardly expect them to travel down specially for the purpose at frequent intervals. It would be a great advantage if a local centre were in existence so that meetings could be held for the benefit of all within the North-West Area.

Mr. R. C. HAWKINS (Area Officer, British Electric Development Association) said that he was partly responsible for the holding of this meeting—the second which the Society had arranged in Manchester. He thought it would be agreed that the number present indicated considerable local interest in illumination. He was glad to see present representatives from Electrical Supply Undertakings, not only in Manchester and Salford but Liverpool and other cities. The audience included representatives of fittings manufacturers, electrical contractors and factory inspectors. He also noted the presence of someone from the Manchester School of Technology. He was specially glad to welcome several representatives of the gas industry—it was, he believed, the first occasion on which the industry had been represented at Fountain Street. The audience was thus drawn from many different sections, which should be regarded as an encouraging sign.

There was no doubt that considerable progress had been made in lighting in the North-West Area during recent years. If Dr. Walsh and Mr. Dow would have a look round Manchester they would see evidence of advances. Progress, in fact, had been general throughout Lancashire: Blackpool was a familiar example of

a seaside resort where the possibilities of light were fully realized.

He agreed that some "architectural lighting" schemes were somewhat crude, and the co-operation of architects in this field was needed. He himself had been interested in the new local showroom which was to be erected very shortly. He had had long discussions with the architect and they both hoped that the showroom, when opened, would prove to be one of the finest examples of architectural lighting in this country.

Mr. A. E. JEPSON said that after this meeting he felt sure there would be quite an accession to the ranks of the Illuminating Engineering Society. It was only by holding such meetings that progress towards the formation of a local centre could be made. He suggested that those willing to help should give in their names.

Mr. E. A. HILTON suggested that in due course a resolution in regard to the formation of a branch might be put to the meeting.

Mr. L. ROMERO (Chief Electrical Engineer, Salford) said that he would like to hear something further on the elimination of glare. Was it agreed that the best solution was to place lights as high up as possible, where this could be done?

Dr. H. LOWERY (College of Technology, Manchester) congratulated Mr. Dow on his interesting address. At the College they had now a section devoted to applied optics. They were dealing with the training of opticians, and there were many opportunities for co-operation between opticians and illuminating engineers. The former were concerned with the correction of visual defects, the latter with the design of methods of lighting, on which the comfort of the eye depended. He was sure that opticians would be glad to aid illuminating engineers in getting satisfactory lighting conditions. He himself would be very willing to join a local branch if it were formed. He would gladly make arrangements for demonstrations at the College and would put his department generally at the service of the branch. (Applause.)

Mr. J. D. NETTLETON remarked that Mr. Dow had given an excellent survey of progress during the past 20 years. No doubt this progress had been substantial —yet in some respects he felt that not enough had been done. Even now the vital importance of impressing the value of good lighting on the user—and this was the whole crux of the matter—was not sufficiently realized. Lighting campaigns had aroused a considerable amount of interest, but the personal touch was necessary in order to clinch matters. The difficulty in persuading the user to improve his lighting was partly psychological. The user first of all looked at him (Mr. Nettleton) knowing that he had come to sell him something—and he was right! (Laughter.) But the user did not realize that the aim of the visitor was also to improve his machinery, for lighting itself was one of the most important tools in any factory. He himself looked upon lighting as a profession rather than a science. A debt of gratitude was due to the scientists who had studied and worked out the essentials of good lighting, but it was now necessary to pass on this knowledge to the user. He would very much like to see a local centre, where they could come together and discuss problems such as those raised in Mr. Dow's address. He was sure that they had present sufficient people to form a nucleus, and he hoped that the meeting would discuss ways and means.

Mr. J. WALSH said that he had much enjoyed the address. He had been a member of the Society for a number of years, but, living, as he did, in Blackburn, he could not often go to London. If a branch were formed in Manchester he would be very pleased to join.

Mr. LAWTON suggested that progress in lighting would be expedited if appliances were cheaper. When one went round to the factories and workshops the invariable reply was "Oh, we cannot afford that." It seemed to him that some articles might almost be made of beaten gold! (Laughter.)

Mr. TOMMINS (Electricity Department, Manchester Corporation) remarked that a local centre would be a valuable addition in the Manchester Area. He had recently been engaged in a series of visits to factories with the object of explaining the benefits of better lighting. One point that was often put to him rather forcibly was: "Well, of course, you come along now and tell us that such and such things should be done—but why didn't the man who carried out the job suggest these steps? I placed my order in the hands of the local man, thinking that he would put up the best job, and this is the result!" A local centre might do most useful work in giving lectures and information to people concerned with all phases of the industry. Efforts should be made to get representatives of all the various interests; certainly contractors should be well represented, as so much depended in practice on their work.

THE CHAIRMAN (Dr. J. W. T. Walsh) said that Mr. Dow had asked him to reply to the various points raised. He (Dr. Walsh) agreed with Mr. Romero that it was an excellent principle to place lighting sources high up when this was feasible, provided, of course, that at the same time adequate working illumination was available. It was not always possible, however, to arrange lighting units quite out of the range of vision, so that proper methods of screening also played an important part. Several speakers had referred to artificial daylight. In one case it was suggested that the use of daylight lamps served to eliminate glare. So far as could be seen at present this was largely a matter of personal impression. It was difficult to apply scientific methods to such problems, as physical measurements did not help, and evidence based on experience was not consistent.

Reference had been made to the desirability of educating the user. This was a point which the Society fully appreciated; if they went through the records of the Society they would see how frequently joint meetings with users had been arranged—how, for instance, in dealing with the lighting of some particular type of factory the attendance of people engaged in this industry was invited. He was very pleased to hear so many speakers refer in encouraging terms to the formation of a local centre. If such a centre were formed one of its chief objects would doubtless be the education of users by means of papers and joint discussions. A local centre could cater for special local industries in a manner that was naturally impossible to those who were not on the spot; such educational efforts depended mainly on personal contact, and could often be carried out much more effectively by a local centre than from London.

The question of the prices of lamps and fittings hardly came within the scope of the Society, but he imagined that in this case the same considerations applied as in others, i.e., that if things were ordered in larger quantities prices would automatically come down. If people could be got to realize that the use of out-of-date appliances was false economy and to substitute modern appliances the question of prices would look after itself.

In regard to the formation of a local centre the suggestion that a resolution should be put to the meeting seemed to be a good one. Such a resolution would be more appropriately initiated by some local member, rather than by someone from London. It would give a clear indication of the amount of support that might be forthcoming for the scheme. He could assure them the Council in London was more than anxious to do everything possible to aid in the formation of local branches, not only in this area but in others. It was, however, naturally felt that such a step should only be taken when it could be seen that there was sufficient local support and adequate membership to make the local section a really live and active branch of the Society. (Applause.)

FORMATION OF LOCAL CENTRE APPROVED.

Some discussion on the terms of the resolution then ensued. Support was given to the resolution by Mr. Hilton, Mr. T. G. Hunter, Mr. Jepson and others.

Mr. DOW explained that it would naturally be expedient to secure a fair nucleus of local membership and evidence of support that would impress others before actually forming a branch. He

thought, therefore, that this should be implied in the resolution, i.e., that it should indicate agreement on the desirability of forming a local section, but should not, at the present stage, affirm that one should be formed forthwith. In response to other queries the Chairman and Mr. Dow explained that anyone who was or became a country member could continue in this category (paying only £1 1s. per annum) until a branch or local section actually came into existence in their area.

Ultimately it was agreed that the resolution should take the following form:—

"That steps be taken towards the formation of a Branch of the Illuminating Engineering Society in the North-West Area, and that this meeting pledges its support to that end."

This resolution, on being put to the meeting, was declared carried unanimously.

THE CHAIRMAN remarked that this was a very satisfactory result indeed. The resolution evidently had the entire approval of those present. There were a number of copies of the journal and forms of application for membership on the table. He hoped that those present who were not yet members of the Society would take these forms away and fill them up and return to the Hon. Secretary.

The Chairman also alluded to the International Illumination Congress to be held in September, 1931, when illuminating engineers from all parts of the world would assemble in this country. The Society was largely interested in making the event a great success. Full particulars would be published in the journal in due course. He felt sure that those present would be anxious to do everything to help the Congress. Many years might elapse before the Congress was again held in this country.

Mr. L. ROMERO then proposed a vote of thanks to Mr. Dow for his address. He must confess that he himself had come to the meeting partly from a sense of duty, and he had not expected to hear anything so entertaining. The address contained a very great amount of interesting material. He also wished to express his appreciation of the excellent manner in which the Chairman had presided over the meeting. Their gratitude was due to both these gentlemen for coming up to Manchester and helping them towards the formation of a local section. (Applause.)

Mr. J. S. DOW, in returning thanks, said that Dr. Walsh and he felt amply rewarded for any trouble they had taken by such an interesting and successful meeting. They both felt that their time had been well spent, and hoped that it would not be very long before they would be in Manchester again.

THE CHAIRMAN, before terminating the meeting, moved a cordial vote of thanks to Mr. F. C. Hawkins and to the Lighting Service Bureau for their hospitality, and this, too, was carried with acclamation.

Shop-Lighting Conditions in Various Towns

We understand that the shop-lighting survey being considered by the electrical industry as part of the national shop and display lighting campaign is providing some very interesting comparative figures between the various towns. As a result of a recent analysis, the following figures have been obtained for Newcastle, Manchester, South Shields and York:—

	Number of Shops Surveyed.			
Town:—	Newcastle	Manchester	South Shields	York
Main Street ...	710	795	315	139
Side Street ...	14	31	117	6
Total ...	724	826	432	145
Standard of Lighting	per cent.	per cent.	per cent.	per cent.
Good	7	10	—	2
Fair	19	20	2	25
Poor	20	12	8	24
Unsatisfactory ...	54	58	90	49
Average wattage per foot run of window ...	watts 48	watts 61	watts 28	watts 57
Percentage using after-hour lighting	per cent. 19	per cent. 28	per cent. 1.5	per cent. 21
Percentage using lighted facia signs	0.2	3.6	0.2	1.4
Percentage using other lighted signs	1.1	9.6	4.2	17.2

In judging the figures given under the "standard of lighting" heading, it may be recalled that the following standards were adopted:—

Good lighting:—
Top reflectors and over 90 watts per foot run.

Fair lighting:—
Top reflectors and 50-90 watts per foot run.

Poor lighting:—
Top reflectors and 25-50 watts per foot run.

Unsatisfactory:—
Top reflectors and less than 25 watts per foot run.
Drop pendants and any wattage.

The scheme thus furnishes an index of the amount of light devoted to the window. It should be explained, however, that the method of classification does not take account only of this consideration, but also takes note of the way in which the lamps are used. Thus any installation would be placed in the fourth ("unsatisfactory") class if bare lamps were visible amongst the goods, even though the wattage was relatively high. By "top reflectors" is understood concealed lighting from above, so that no lamps are visible.

The Organization of the Electrical Industry in Great Britain

A comprehensive treatise on the above subject, by Mr. P. Good, containing information originally collected for the British National Committee of the International Electrotechnical Commission, has recently been published by the Institution of Electrical Engineers. The author deals with the British electrical industry under eight main headings, namely: (1) the Institution of Electrical Engineers, (2) scientific (including research), (3) communications (telegraphs and telephones), (4) manufacturing, (5) supply, (6) transport, (7) industrial and commercial development, and (8) British affiliations in international electrical affairs. Like other bodies, the Institution has two main objects, (*a*) to act as a central organization for the advancement of electrical science and engineering, and (*b*) to act as a clearing-house for information and ideas. Its own committees are numerous, and it is also interested, more or less directly, in the activities of many other bodies, amongst which the Illuminating Engineering Society and the Association of Public Lighting Engineers are mentioned.

The operation of all these various sections is illustrated by tabular diagrams showing, for example, how the various phases of manufacturing, communications, or supply are linked together. Mr. Good's survey acts as a useful reminder of how widespread the ramifications of the electrical industry have become.

Sheffield Illumination Society

The last paper included in the 1930 session was read by Mr. J. Whitehead (a past president of the Society), before the members of the Sheffield Illumination Society, at the Corporation Lighting Department, on Monday, the 3rd November last. The subject was "Store-keeping." Mr. Whitehead gave some interesting information regarding the work carried out in connection with the stores department. The President (Mr. G. Sayer) presided, and conveyed the thanks of the meeting to Mr. Whitehead for his informative paper.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society and is based on outside contributions.)

The Twenty-Second Illumination Design Course

A Survey and Synopsis

(Communicated.)

A LECTURE is defined by the Oxford Dictionary as a discourse delivered for the instruction of a class or other audience. The lectures which formed the programme of the twenty-second Illumination Design Course, held at the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, W.C., on Monday evenings, commencing on October 13th, and concluded on November 24th, may truthfully be acclaimed as falling within the Oxford Dictionary definition.

In every instance the audience was large and enthusiastic, absorbing all the information provided, challenging less well-understood points, and testing the lecturers with questions indicative of their interest. Without doubt the twenty-second Design Course was an immense success.

The field of investigation covered by the course was initiated by a lecture on October 13th by Mr. W. J. Jones, who took as his subject "Lighting Principles and Recent Progress." With a wealth of information at command, he explained the fundamental units used in illumination and their application. Proceeding, the lecturer dealt with the bearing of intensity and quality of light on production, and concluded a commandingly interesting and invaluable talk with a number of practical demonstrations illustrating how the design of fittings affected light control. The discussion was opened by Colonel W. A. Vignoles, in his customary able practical manner, and provided an excellent beginning to the many questions with which the lecturer was deluged.

The second lecture of the series was given by Mr. T. Catten, whose subject, "What the Shopkeeper Does with Light," enabled him to introduce all his valuable shop and display-lighting campaign experience. Mr. Catten explained not merely why more light is an economic proposition to place before the shopkeeper, but the most efficient manner of obtaining it. In graphic detail he told the story of what E.L.M.A. is doing to develop shop lighting, then proceeded to indicate the modern trend and movement in the illumination of display, illustrating each stage with apt simile and arresting demonstration. The value of facia lighting was stressed, and all the advantages to be gained by the shopkeeper using after-hour lighting were succinctly put by Mr. Catten. Not the least fascinating part of a most invaluable lecture was the wealth of diagrams, lantern slides, and ocular demonstrations with which the lecturer successfully pushed home his points. Mr. R. W. Hughman, of *The Electrical Times*, in contributing the opening remarks of a very lively discussion, emphasized Mr. Catten's appeal for more light in the modern shop.

The electric lamp was the dominating factor in every lecture of the course, and Mr. L. E. Buckell, in an exhaustive survey of the proper means of getting the best out of the modern electric lamp, said that the advance in really high-class illuminating has only been made since 1914. He described the evolution of the electric lamp from Mr. Joseph Swan's first electric lamp some 51 years ago to its latest expression. What are the essentials and fundamentals of an electric lamp? The characteristics of the modern lamp are naturally those controlling its performance. The three things to be considered are the light output, the consumption, and the life of the lamp; for these give its efficiency, and by efficiency is meant the nature of the light output measured in lumens to the input measured in watts.

Mr. Buckell, continuing with the idea, said the life of a lamp depends upon the light output it is made to give, for, as he sagely remarked, you may make the lamp give any light you want by overrunning or underrunning it. The higher the temperature the shorter the life, for there is an economic limit on life.

The best results are obtainable when the lamp is run on the voltage it is rated for; good results are not to be expected unless you keep the lamp somewhere near the voltage it is designed for, and it must not be forgotten that a lamp begins to deteriorate as soon as it is put into operation.

Naturally, a lecture so practical, teeming with information and fact, led to a vast number of questions, which were tactfully and appreciatively replied to by Mr. Buckell, concluding one of the most informing talks of the course.

A feature of all lecture programmes is variety. This feature is often its salvation, or at least it provides for a variety of interests, and it is unfair to expect from the same class of audience a full measure of interest for each subject that is dealt with.

The twenty-second Design Course possessed the element of variety, and in this manner the volume of interest was sustained to the end.

After the story of the modern electric lamp came Mr. H. Lingard, with all the history, data and experience at command, to demonstrate the scope of electrical advertising. What Mr. Lingard does not know about "Electric Signs and Floodlighting" is of little value to anybody, and his lecture revealed a fund of knowledge on the way in which the electric sign has developed that was astounding. Not the least important item of the evening was the many demonstrations of the way the electric sign can be used, and the many variations of construction in its modern application. Mr. Lingard hinted that during the next ten years we may expect some very important developments, marking an advance in signs that is little dreamt of.

The discussion which followed was opened by Mr. J. Pearce, President of the Master Sign Makers' Association, who emphatically stated that the electric sign was but in its infancy, and that a great field of electrical

advertising awaited them, a more powerful form of publicity than any other in the realm of advertising.

From the electric sign to "Light in the Office" was not a long step, and Mr. F. Marsh, after outlining the cost of daylight, such as window cleaning, extra heating owing to windows, and the accumulation of dirt and dust, dealt with the requirements of good office lighting which were correct light, which implies quality, and a correct amount of light, which means quantity. Upon these two factors the lecturer based his conclusions, and stated that the ideal for offices was totally indirect lighting, the diffusion of which was excellent, and there were no shadows; it, however, involved a higher wattage.

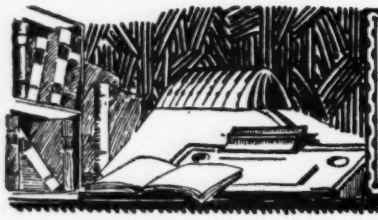
Another point that emerged was that no local lighting should be installed in the absence of good general lighting. Dr. Crowley, in opening the discussion, emphasized the harmfulness of eyestrain produced by poor lighting, for it means inefficiency and money, and advocated the avoidance of all abrupt lighting changes, and a gradual change with no fierce contrasts.

The question of "Lighting for Factories and Workshops," Mr. S. Anderson, who has made this matter a serious study, dealt with in masterly fashion. He set out an imposing list of advantages, i.e., greater accuracy in workmanship, less eyestrain, more contented workers, the plant kept in better order, shop supervision facilitated, less spoilage and increased production. A formidable and incontestable array.

The essentials of good factory lighting were outlined as adequate light for the work, freedom from both direct and reflected glare, the elimination of harsh shadows and sharp contrasts, a fair degree of illumination on side walls, and, in some cases, on ceilings; the lighting equipment should be suitable and designed for the conditions under which it has to be used; it should be simple, reliable and easy of maintenance, and the quality of artificial light should resemble, as closely as possible, the colour quality of daylight.

The concluding lecture, "The Lighting of Cinemas, Hotels and Public Buildings," was a fitting epilogue to the series. Mr. R. W. Maitland brought to his subject all the art and ingenuity of the architect, pleading for that unity of design and lighting system that alone can produce the perfect building. His lecture was replete with new views, a new setting of lighting problems in their relation to the cinema, hotel and the civic building. A number of fascinating lantern slides told the story effectively of lighting tendencies in European centres, and indicated their influences in the trend of lighting in England to-day.

Lectures covering so vast a field of investigation cannot fail to have a good effect upon the case for electric lighting as it may and should be put. The lecturers released large masses of information, and added in this way to the sum of knowledge to all who attended.



REVIEWS OF BOOKS AND PUBLICATIONS RECEIVED

THE THEORY AND DESIGN OF ILLUMINATING ENGINEERING EQUIPMENT, *by L. B.W. Jolley, J. M. Waldram and G. H. Wilson. (London, Chapman & Hall; pp.* 709 + xxxi. *Price* 45*s. net.*

To say that this book is by far the best and most complete that has ever appeared on the subject would give a very inadequate impression of the skill and thoroughness with which the authors have carried out their task. Each of the many books on illuminating engineering which have appeared since the war has neccessarily included a considerable section on equipment and its design, but it has been reserved to the authors of the present book—who, we note with pardonable national pride, are three of the best-known English illuminating engineers—to produce a really impressive treatise on this important subject.

The first of the five parts into which the book is divided deals with fundamental priciples. The first chapter describes some of the physiological factors involved, while Chapters II, III and IV deal with such matters as polar curves, utilization factors, isolux diagrams, regular and diffuse reflection and transmission.

The second part is devoted to a description of sources of light. This is a very valuable portion of the book, but it is unfortunately marred by a complete absence of any mention of non-electrical sources. The failure to recognize that gas lighting has an important part to play in modern illuminating engineering is, in fact, the only serious criticism which can be levelled at the book. It is to be hoped that in future editions this most unfortunate omission will be supplied.

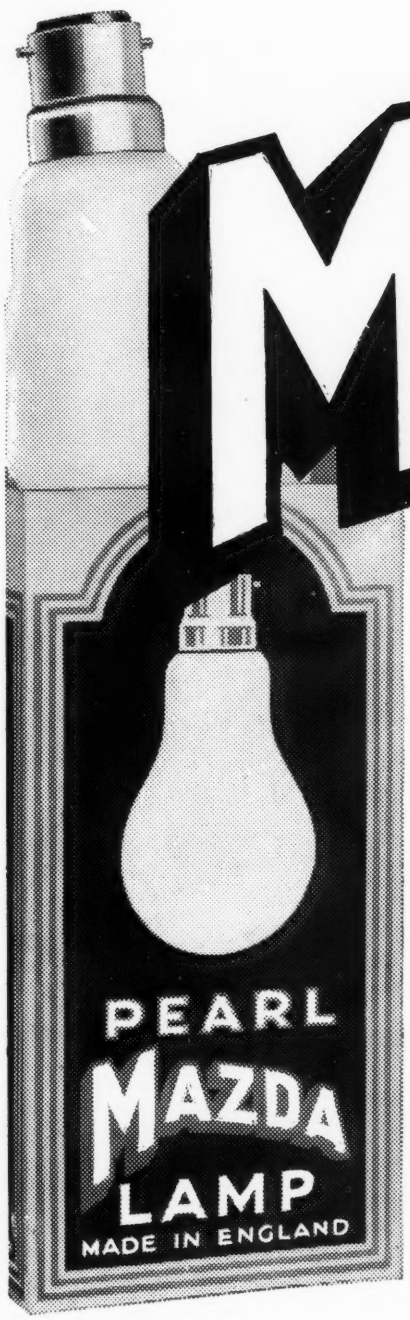
More than half the book is contained in Part III, which is itself divided into no less than eight sections, dealing respectively with (i) types of lighting equipment classified according to their uses (interior lighting, street lighting, floodlighting and display lighting), (ii) the mechanical design of lighting equipment, (iii) reflecting media and their use in design, (iv) diffusing media,(v) refracting media, (vi) the design and performance of optical projection systems (vii) the use of coloured media, and (viii) special equipment, such as that used in stage lighting, kinema studio lighting, etc.

Part IV deals with auxiliary equipment which is not strictly part of the lighting system, as, for example, cabling systems for street lighting. It might possibly be objected that the matters dealt with in this section do not properly belong to the field of illuminating engineering, but there is no doubt that the practising illuminating engineer will be grateful to the authors for having interpreted their terms of reference so widely. The section on traffic control in this part is particularly good.

The fifth part of the book consists of six appendices, giving respectively (i) a discussion of manufacturing tolerances from the statistical standpoint, (ii) a table of reflection characteristics, (iii) various optical projection data, (iv) tables and diagrams used in illumination design, including a nomogram for finding corresponding angles of incidence and refraction for any value of refractive index, (v) a large number of diagrams of lamp characteristics, and (vi) extracts from all relevant British Standard Specifications.

The book has a good index, and in addition the back inside cover and flyleaf show in tabular form the page at which is to be found information on any particular aspect of any given type of lighting equipment.

The book is exceedingly well printed and is profusely illustrated, not only with diagrams but also with a large number of excellent half-tone plates. Unfortunately a book of over 700 pages printed on a good substantial paper presents a very difficult problem to the bookbinder, and it might, perhaps, have been better if the book had been divided into two, or even three parts. This, however, is a comparatively minor matter, and the general impression left after perusal of the book cannot fail to be one of general satisfaction at the result of what must have been a most cordial co-operation between authors and publishers. The price must be regarded as very moderate, and there can be no doubt that the book will have a wide appeal and will do much to further the cause of good illumination, not only in this country but also abroad.



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A Visit to Messrs. Gamages (West End) Limited, London

BY the courtesy of the Directors, a visit of members of the Illuminating Engineering Society to the new store of Messrs. Gamages (West End) Ltd., near the Marble Arch, London, took place on November 18th. On arrival at 5 p.m., the party were met by a posse of guides, amongst whom members of the staffs of Gamages Ltd. and the General Electric Co. were included. Thanks are due to the efforts of these gentlemen in enabling us to see so much within a limited time.

The erection of this new seven-storey building, which was opened on September 17th last, has been watched with much general interest. We understand that it was erected, equipped and staffed in the short space of 16 months. The design of this modern building has many novel features of interest, and the artificial lighting throughout the stores is attractive and interesting. The lighting of the series of show windows at once commands attention. This is, in general, affected by a combination of lamps in silvered glass-top reflectors, in combination with footlights, and in some cases supplementary spotlights are also used. It is stated that there are upwards of 500 shop-window reflectors, furnished with colour screens, in use in the windows.

FIG. 1.—An effective example of Window-lighting Reflectors above, and Footlighting below. Specially designed spots are also used.

Each entrance has distinctive features. The central main entrance, in Oxford Street, and the Part Street corner entrances are equipped with illuminated canopies, columns and architraves. The concealed lighting immediately inside the main entrance (Fig. 2) makes a pleasing picture. We were particularly struck with the lighting of the staircases connecting with the side entrances, a dominant feature being the long illuminated cornice (444 ft. long), glazed and opal glass, with 20-watt lamps on 6-in. centres. Numerous examples of special concealed lighting on landings are also to be noted, one typical device being the use of concealed lights in arched recesses, one of which is visible in the right-hand lower corner of Fig. 2.

The ground floor is of imposing dimensions, and is lighted by 120 two-tier opalescent glazed pendants, with bronze-coloured art metalwork. It was understood that the consumption for this floor is at present somewhat less than 1 watt per square foot, and the illumination about 5 foot-candles, which is well up to the figure one would expect. (In actual fact, owing probably to the general "soft" and diffused effect, one received the impression that the illumination was higher than this.) Somewhat similar methods are used on the other floors and in the basement, though allowance has to be made for the lower height available. Fittings throughout are of the diffusing variety, but on each floor a distinctive shape is adopted. An interesting and somewhat unusual device in the basement was the use of rectangular diffusing fittings, equipped partly with

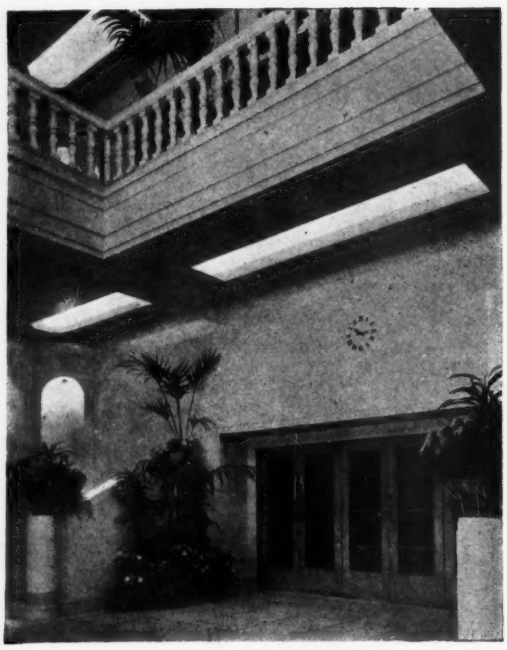


FIG. 2.—Showing Recessed Cornice Lighting in main entrance, lobby, and on first landing of main entrance.

daylight lamps and partly with ordinary ones, for the illumination of carpets, etc.

In addition to absence of glare, another good feature is the almost universal adoption of concealed local lighting for glass showcases; this is, of course, familiar in the modern store, but is not usually adopted to quite the same extent. Throughout the building were observed numerous little "dodges," such as concealed lights above cupboards, etc., which add to the interest of the lighting. One typical device (Fig. 7) is the illuminated laylight fitting in wired-plate amber glass which serves the soda fountain area.

The restaurant, on the fourth floor, where visitors ultimately assembled, is illuminated by somewhat novel methods, involving altogether about 1,300 ft. of cornice-reflector, enamelled stone colour and glazed. An additional decorative device (Fig. 5) is the illumination by concealed "Striplite" lamps of the canary-coloured curtains covering each window.

FIG. 3.—Showing the lighting of one of the main bays on the ground floor by specially designed lighting pendants, glazed opal with bronze metalwork.

FIG. 4.—Illustrating the phasing system of Staircase Lighting to the "below-ground" floors.

FIG. 5.—A view of Window in Restaurant. These are illuminated by "Striplite" lamps concealed at base of window.

FIG. 6.—Lower Ground Floor. General view of China and Glass Department, showing lighting pendants, illuminated display cabinets and under-counter lighting.

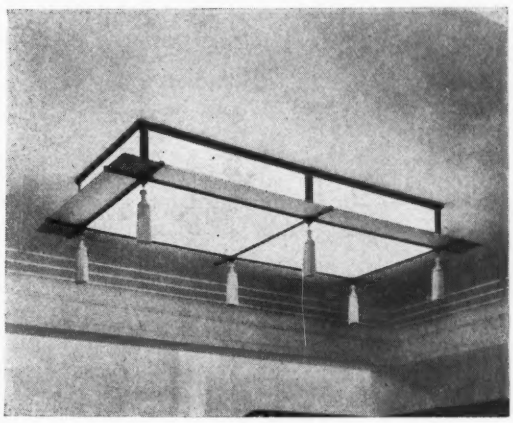


FIG. 7.—Illuminated Laylight-type Fitting of Wired-plate Amber-tinted Glass in Soda Fountain.

An original feature in the exterior lighting of the store is the floodlighting of pillars in crimson, with a green background, a method which is applied to a section of the building above the main entrance. Visitors were also interested in the preparations being made for the new animated sign, which is to be a feature of the Christmas lighting. Unluckily this novel sign, which is due to the ingenuity of M. Jacopozzi, the famous French designer, had not been completed at the time of the visit.

Equally interesting to the electrical engineer is the series of switchboards in the basement which serve the building and the flats above the stores, and where the 6,000-volt supply is stepped down to a 3-phase 4-wire system.

Following their inspection of the lighting visitors assembled in the Restaurant and were entertained to tea. Before the members dispersed the President, Colonel Kenelm Edgcumbe, took the opportunity of expressing the Society's appreciation of the many interesting and effective lighting devices they had seen, and on behalf of the members thanked Messrs. Gamage for their hospitality.

In the unavoidable absence of Mr. Eric Gamage, Mr. H. W. Hankins, the General Manager, briefly replied on behalf of the firm.

We are indebted to the General Electric Co. Ltd. for the pleasing illustrations accompanying this note, and for much of the information incorporated therein.

Painting with Light

Readers will recall that we recently drew attention to the description of the lighting at the International Exhibition, held in Barcelona last year, which appeared in the *Transactions* of the Illuminating Engineering Society (U.S.A.). We have since received from the Westinghouse Electric and Manufacturing Company, who were closely associated with the floodlighting at this Exhibition (2, Norfolk Street, Strand, London, W.C.2), a booklet entitled "Painting with Light." This contains a series of 12 coloured plates showing the coloured floodlighting at Barcelona. The effects illustrated are certainly very spectacular, and deserve the description "painting with light." Coloured searchlights and floodlighting play an important part in the effects, but the most distinctive feature of this wonderful display, was, no doubt, the series of illuminated cascades and fountains. Of special interest are the duplicate pictures comparing the "day" and "night" appearance of various sections of the Exhibition. We are asked to mention that the company will gladly forward a copy of this booklet to any member of the Illuminating Engineering Society who makes application to them at the above address.

Gas Equipment in a Surrey House

(*Communicated.*)

THE illustrations on this and the following page show interior views of some of the rooms in a fairly old house in Surrey which has recently been remodelled to bring it into line with modern ideas on house equipment.

In this work of remodelling, an endeavour has been made to retain as far as possible all the attractive features of the house as originally designed, such as the mantelpieces, the carved and panelled doors with their beautiful brass hinges, and the carved wood decorations on the ceilings.

With one exception, all fireplaces have been equipped with modern gas fires, care being taken, of course, to choose designs which harmonize with their surroundings. Fires of the standard type with upright radiants are fitted in the bedrooms, including those of the domestic staff. Fireplaces in the living rooms are equipped with gas fires closely resembling glowing coke or a blazing log fire. In the hall and on the landings gas radiators have been fixed.

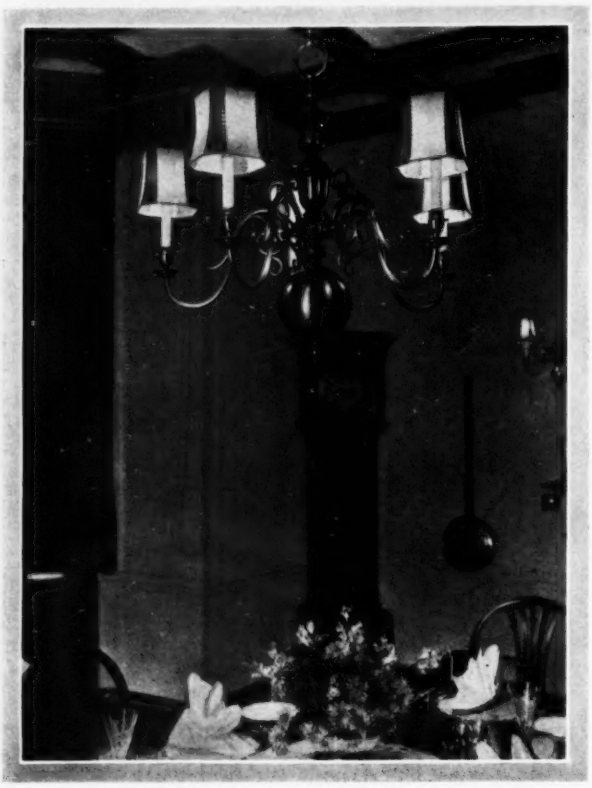


FIG. 1.—A beautiful Pendant, with Gas Candle Burners, fixed in the dining-room.

Most, though not all, of the lighting is by gas. The illustrations show some of the different types of gas fittings used. In the dining-room there is a beautiful antique brass pendant (see Fig. 1) fitted with five gas candle burners. In the drawing-room (Fig. 2) there is a gas standard lamp with standard finished in gilt. This can be connected up to points provided near the skirting by means of a special bayonet fitting. The "bayonet" on the end of the flexible tube is pushed into a socket fixed on the gas supply pipe, and is given a turn. This turn not only fixes the bayonet into position, but turns on the supply of gas. In the library (Fig. 4) there is another standard lamp, also arranged for easy connecting-up to any desired point. In one of the bedrooms (Fig. 5) there are pendants, with "shades" consisting of three tiers of lustres. The other lighting fitting in this bedroom, and those in other bedrooms, bathrooms, etc., throughout the house, are simple inverted incandescent gas brackets fitted with silica-ware shades.

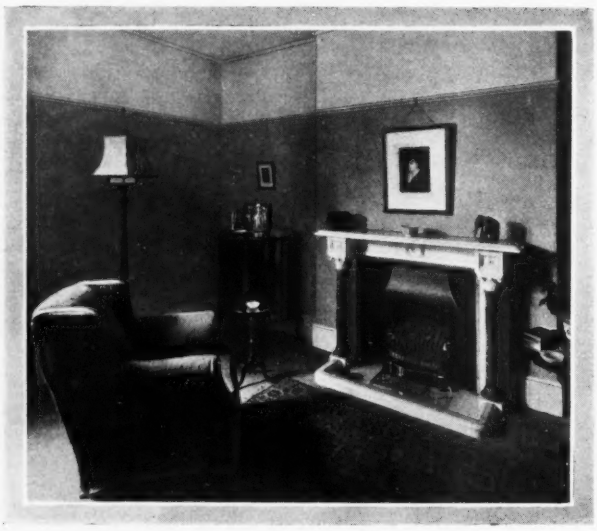


FIG. 2.—The Drawing-room, showing Gas Log Fire and Gas Standard Lamp.

An attic with a sloping roof has been turned to good account as a workroom (see Fig. 5). It can be used for washing, drying and ironing clothes, and for many other purposes, such as cutting out material, dressmaking, and the like. It is well equipped with airing cupboards. The one to be seen on the left is heated by a special linen-airing cupboard heater fixed in the bottom of the cupboard. This is an inexpensive little appliance, which can be fixed in almost any cupboard. On the assumption that the shelves of the cupboard have spaces to allow of the upward passage of hot air through them, the only other work involved is the drilling of a few small holes (top and bottom) in the sides or door of the cupboard. This appliance is meeting a long-felt need in many homes.

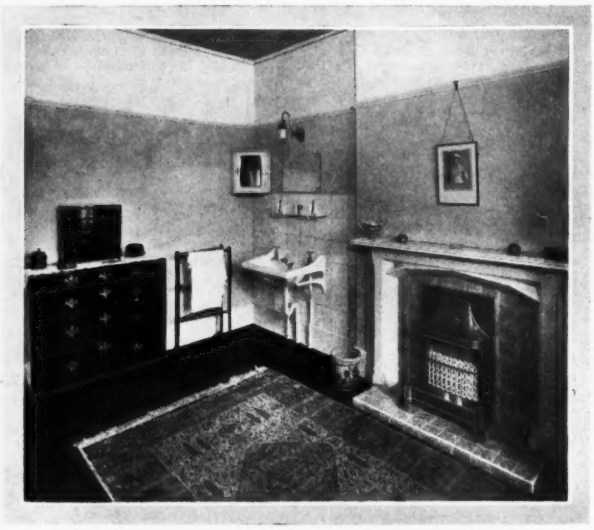


FIG. 3.—A Dressing-room with Gas Fire and Gas-lighting Fitting, with Hot-water Tap to Wash Hand Basin. The water is heated up either by gas or coke in the kitchen.

It is quite safe, the small gas flame which provides the heat being enclosed in the casing. The room is lighted and heated by gas. Hot water is always available

FIG. 4.—The Library, with Gas Standard Lamp and Gas Fire fitted into existing grate.

at the tap above the deep sink, this being heated up by either a gas or a coke water heater in the kitchen. Water can be brought to boiling point quickly in a kettle over the pedestal boiling ring to be seen on the hearth. On the left of the illustration is an internally heated gas iron, connected to the gas supply by one of the new bayonet connections.

The kitchen of this house is equipped on very up-to-date lines. It has both gas and coke water heaters, the former for summer use, the latter for winter use. The fuel used in the coke water heater is quickly ignited by a gas poker burner. The cooker is one of the newest elevated ranges, finished in enamel and with thermostatic control of oven temperatures. It is ventilated by a hood, which is made of sheet iron, with condensa-

FIG. 5.—An All-gas Workroom, showing inverted incandescent gas bracket, gas fire, pedestal gas boiling ring on hearth, gasfired linen-airing cupboard heater, and internally heated gas iron

tion troughs on three sides, and is finished off in aluminium paint. The refrigerator is one of the noiseless gas-operated types with no moving parts. The kitchen (a large one) is lighted by two gas pendants fitted with vitreosil bowls and cluster burners, taking three No. 1 inverted mantles.

The general equipment of this house with gas-cooking, water-heating, heating, refrigerating and lighting appliances is typical of what is being provided in many of the new and beautiful houses now being built round about Dorking, Reigate and Boxhill. It is gratifying to note that in these and in other districts in Surrey serious efforts are being made to build only houses which are attractive in external design and colourings. It is equally satisfactory to know that the vast majority of these new houses—the homes of the future—will send out very little, if any, smoke and soot to contaminate the air and damage both vegetation and buildings. Traffic along Surrey lanes and by-ways will not in future be blocked by cumbersome coal wagons, and the occupants of the houses will have a degree of comfort and leisure enjoyed by only a few of their parents and by none of their grand-parents.

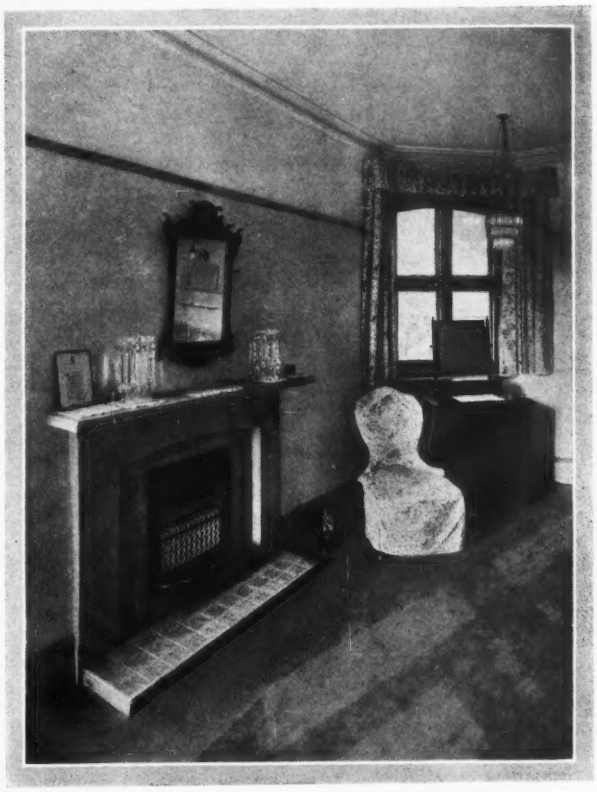


FIG. 6.—One of the Bedrooms, showing Gas Lustre Pendant and modern Gas Fire.

The Artistic Mind in the Gas Industry

A noteworthy tribute was paid to the development of artistic taste in the gas industry by Mr. E. H. Symonds, managing director of Reville, Ltd., of Hanover Square, and President of the British Fashions and Fabrics Bureau, in an address to the Bradford Textile Society, on 17th November, on "Fashion's Influence on the Sale of Textile Fabrics."

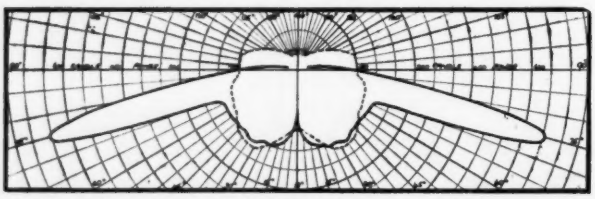
Considerable success, he said, had resulted from the British Commercial Gas Association having approached the President of the Royal Institute of British Architects for help and guidance in beautifying such a prosaic domestic article as a gas stove. Could one imagine anything more inartistic than a pre-war gas stove? Compare the present position of the gas industry with that of former days. Whatever style one's dining-room, drawing-room, or business office might be, whether the scheme was one of artistic simplicity or dignified and beautiful elaboration, one could obtain a gas stove that was in perfect harmony with the decorative sense. Thus, by following the trend of fashion in regard to interior decorating, the gas industry had not only sold more stoves but had actually increased the National consumption of gas. (*The Gas World.*)

Street Lighting with Gas in Prague

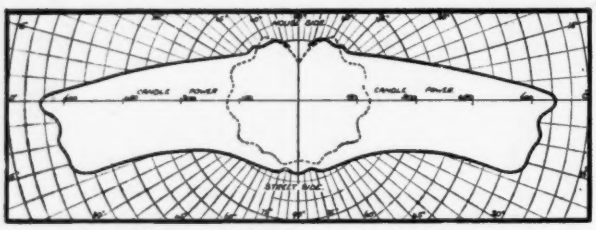
Experiments with Prismatic Glass Plates

By PAUL GRUNDFEST

IN the address on the subject of "Street Lighting," delivered at the Holophane International Conference last July, Professor J. Teichmüller emphasized two points as of paramount importance in public lighting to-day. These were: (1) the desirability of asymmetric distribution of light; and (2) the necessity of obtaining freedom from glare.



(*a*) Vertical Candle-power Distribution Curve, with 4-light superheated burner.



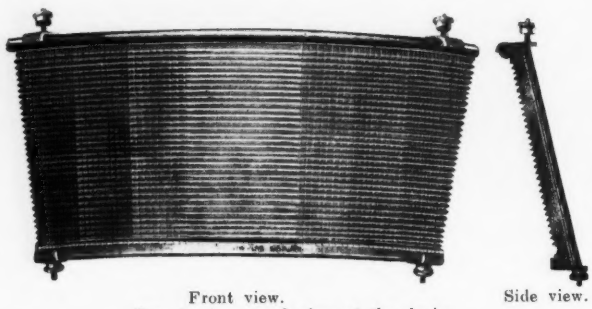
(*b*) Plan Candle-power Distribution Curve, through a 75° cone.

FIG. 2.—Showing Distribution of Light.

So far as electric lighting is concerned, the first condition can now be fulfilled; for example, by means of the asymmetric Holophane street-lighting units. The second condition can be complied with to a great extent, dazzling being at least reduced to a minimum.

The position, however, is otherwise in towns and cities where gas lighting is in use; for example, in many cases where concessions have still a long time to run and where the high initial cost of a complete new installation in itself militates against the adoption of electric lighting. Hitherto it has scarcely been possible to influence materially the distribution, in specific directions, of light from gas lamps, as is customary with electric light. The first step recently taken by the Holophane Company, i.e., the introduction of prismatic glass plates which render it possible to obtain asymmetric lighting from gas lamps, is therefore of considerable importance. The design of the prismatic surfaces of these plates is such that a distinctive direction of light is achieved in a plane at right angles to the plate. Such plates can be incorporated in the fitting in such a way that the main direction of light distribution is along the length of the street; if need be, the direction can be inclined somewhat towards the centre of the roadway when lamps are mounted along the kerb and not in the centre of the roadway. The general appearance of this device is illustrated in Fig. 1, whilst Fig. 2 shows the nature of the light distribution. In Fig. 3 we have a record of measurements made in Prague. The tests were made on a Bamag-Meguin six-burner lamp, the candle-power being measured in the direction of the main beam furnished by the prisms, and also perpendicular thereto. Illumination was measured on a horizontal plane 1 metre above ground level and is recorded in international lux. The curves indicate that at a distance of 10 metres from the source of light the illumination is increased by 200-300 per cent. when the prismatic plates are used.

Moreover, the diversity factor (ratio of maximum to minimum illumination), which was as high as 35 : 1 when the prismatic plates were not in use, was improved to about 9 : 1 when they were adopted. The only difficulty encountered initially during these experiments was that the method of supporting the plates in the lanterns adopted by the local gas company was somewhat primitive and unstandardized. It is understood, however, that this defect is being eliminated by Messrs. Bamag-Meguin, who have introduced into their various models a satisfactory method of mounting the prismatic glass plates.



Front view. Side view.

FIG. 1.—A general view of the device.

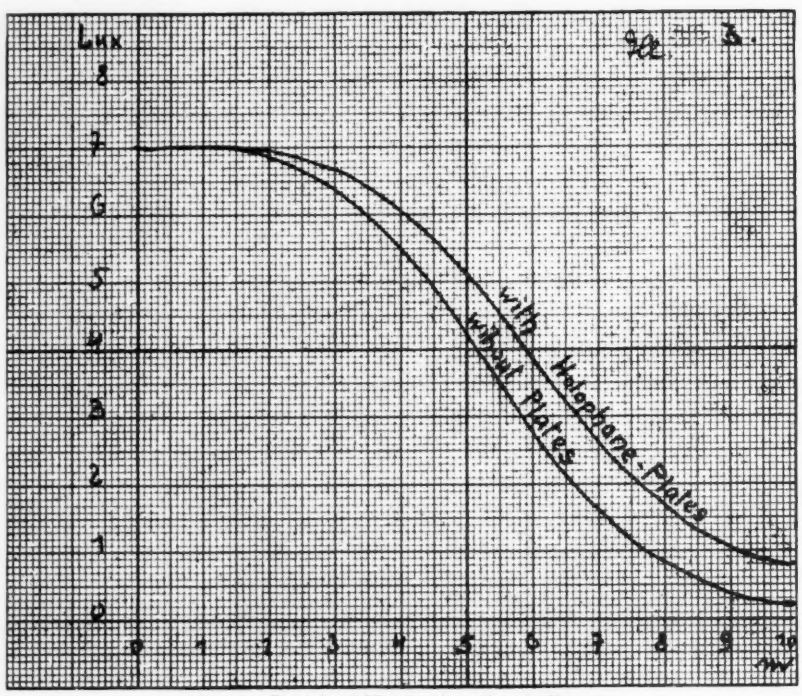


FIG. 3.—Records of Illumination taken in Prague.

(The use of these prismatic plates with gas lamps is an interesting development. We shall be glad to hear particulars of further developments in Prague. It is evident that, as Mr. Grundfest suggests, the position of the prismatic surface in relation to the mantle needs to be determined with care, and standardization would seem desirable.—ED.)

Some Further Examples of Floodlighting

IN our last issue we referred to an outstanding example of floodlighting applied to classic buildings, the illumination by night of the Acropolis at Athens.

In this number we present a few more interesting examples of floodlighting, for which we are also indebted to Messrs. Korting & Mathiesen Electrical Ltd.

The first of these refers to the floodlighting of a large generating station. It emphasizes the combined value of a light-coloured surface and water in the foreground, and is interesting as one of the few examples we have come across of an electrical generating station being floodlighted. It is, when one comes to think of it, rather singular that the generating station, whence the current that renders floodlighting possible is derived, so rarely makes use of its own power for purposes of display. It is true that some power stations are mercifully left in darkness, but other modern buildings are by no means without distinction.

FIG. 1.—The Floodlighting of a large Generating Station.

FIG. 2.
The Floodlighting of the very extensive Frontage of a large Factory abroad.

The second picture shows the floodlighting of the imposing frontage of a large boot factory by means of projectors mounted in the front basement, whilst Fig. 3 is a pleasing example of the illumination of a bridge by night.

These examples are only a few out of a considerable number appearing in the last issue of *The Kandem Quarterly Review*, which demonstrates the varied applications of floodlighting. Amongst others, we notice a picture of a floodlighted petrol station, which is built according to distinctive architectural design. The general effect in this case is in marked contrast to some petrol stations, which are justly regarded as eye-sores. Other pictures relate to churches, picture palaces, municipal buildings, etc.

FIG. 3.—The Floodlighting of a Bridge—a charming night effect.

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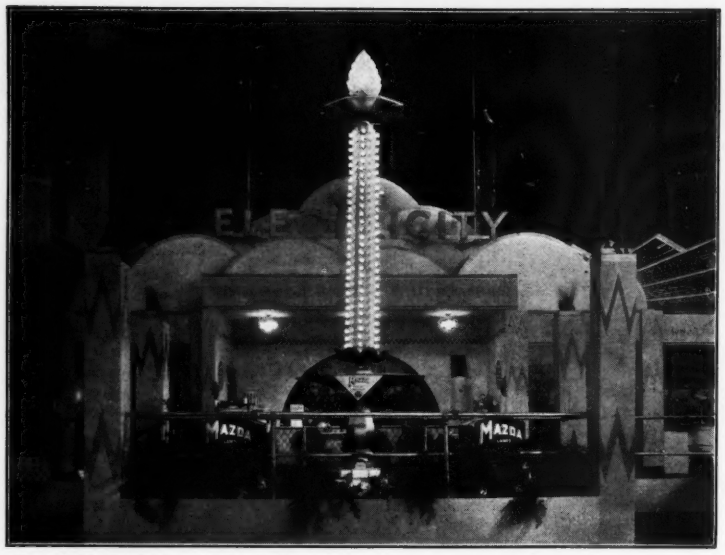
TRADE NOTES & ANNOUNCEMENTS

A LARGE ELECTRIC CANDLE.

Local exhibitions throughout the British Isles tend to become increasingly common. In some cases, a display originally attempted as an experiment has become a regular annual feature. Electrical exhibitions, in particular, are growing in number, and considerable ingenuity is sometimes exercised in order to devise exhibits which catch the public fancy. We are told that one of the chief topics of conversation during the Annual Exhibition held not long ago in Bristol, was the Mazda Electric Candle—the singular pillar of light erected on the stand of the Corporation Electricity Department. Our illustration conveys a good idea of this novelty. Lighting devices naturally suggest themselves in connection with electrical exhibits. Light, however, now plays a great part in almost all exhibitions—for nearly all displays make an appeal to the eye—and a visit to any of the exhibitions held from time to time at Olympia would confirm this.



The Mazda " Electric Candle," displayed at the recent Annual Exhibition at Bristol.

A GOOD EXAMPLE OF CHURCH LIGHTING.

In few fields has there been such a marked change during recent years as in church lighting. At one time it was difficult to induce people to depart from the conventional pendant fittings. There was a tacit assumption that some visible light source was necessary—perhaps as a reminder of the oil lamps which used to hang in cathedrals. There seems to have been little real reason for this preference, however, and at the present time much more latitude is allowed. It is by no means unusual to see churches lighted without any actual fittings being visible. A case in point is afforded by St. Luke's Church, Gloucester, recently illuminated by Gecoray floodlights. In the picture before us no source of light is visible; yet the church as a whole appears quite well illuminated. We understand that the electrical contractors were Messrs. L. C. Mitchell & Co., of Gloucester, whilst the fittings and lamps were supplied by the G.E.C. Cardiff branch.

" THE REFLECTOR."

This is the title of a periodical issued by the Benjamin Lighting Service " in the interests of better industrial lighting." The first copy is an attractively got-up and readable production, evidently prepared to appeal to users of light. There is an introductory note, entitled " Seeing is Producing," an illustrated account of a recent Benjamin installation, and a descriptive account of the Glassteel reflector, which has the quality of allowing some light to penetrate upwards whilst directing most of the available flux on the working area. We may also mention a very effective photograph reproduced on the final page illustrating the advantage of elliptical-angle reflectors as compared with the antiquated conical ones for the illumination of machinery employed in hosiery manufacture.

LIGHTING PUBLICITY IN GERMANY.

We have received from a correspondent in Berlin a copy of " *Der Werbeleleiter,*" which is issued by the Union of supply undertakings in that city. Eminently readable, this publication is noteworthy for its illustrations. There are, for example, some amusing reproductions of Japanese posters advocating the use of electricity, and a few vivid comic pictures emphasizing the drawbacks of a pre-electric existence. Of special interest is an illustrated article by Dr. H. Gerhard Schmidt, showing typical display lighting outside buildings in Berlin. A feature is the use of " luminous lines," which seems to have become popular in Germany recently.

THE " WIGAN REVIEW."

We have previously commented upon the enterprising little bulletin issued under the above title by Messrs. Heyes & Co. Ltd., of Wigan. A recent issue contains illustrations of " something old," a water-tight push which has been supplied for over 20 years, and " something new," which is the universal " Lacent " fitting recently illustrated in our columns. The installation featured in this number is the Model Dairy Farm in the Himley Estate of Viscount Ednam. There is a photograph of what is described as " the Ritz-Carlton of all cowsheds," which is lighted by " Wigan " prismatic Bulkhead Fittings, and altogether equipped in the finest possible way.

This copy of the " Wigan Review," like preceding issues, is marked by a sturdy local patriotism, and embellished by an illustrated description of one of Wigan's historic buildings. On this occasion the fine Parish Church, dating from the 14th century, is selected for notice. It is interesting to observe that, according to the survey of William the Conqueror, a church stood on the present site even in Saxon times.

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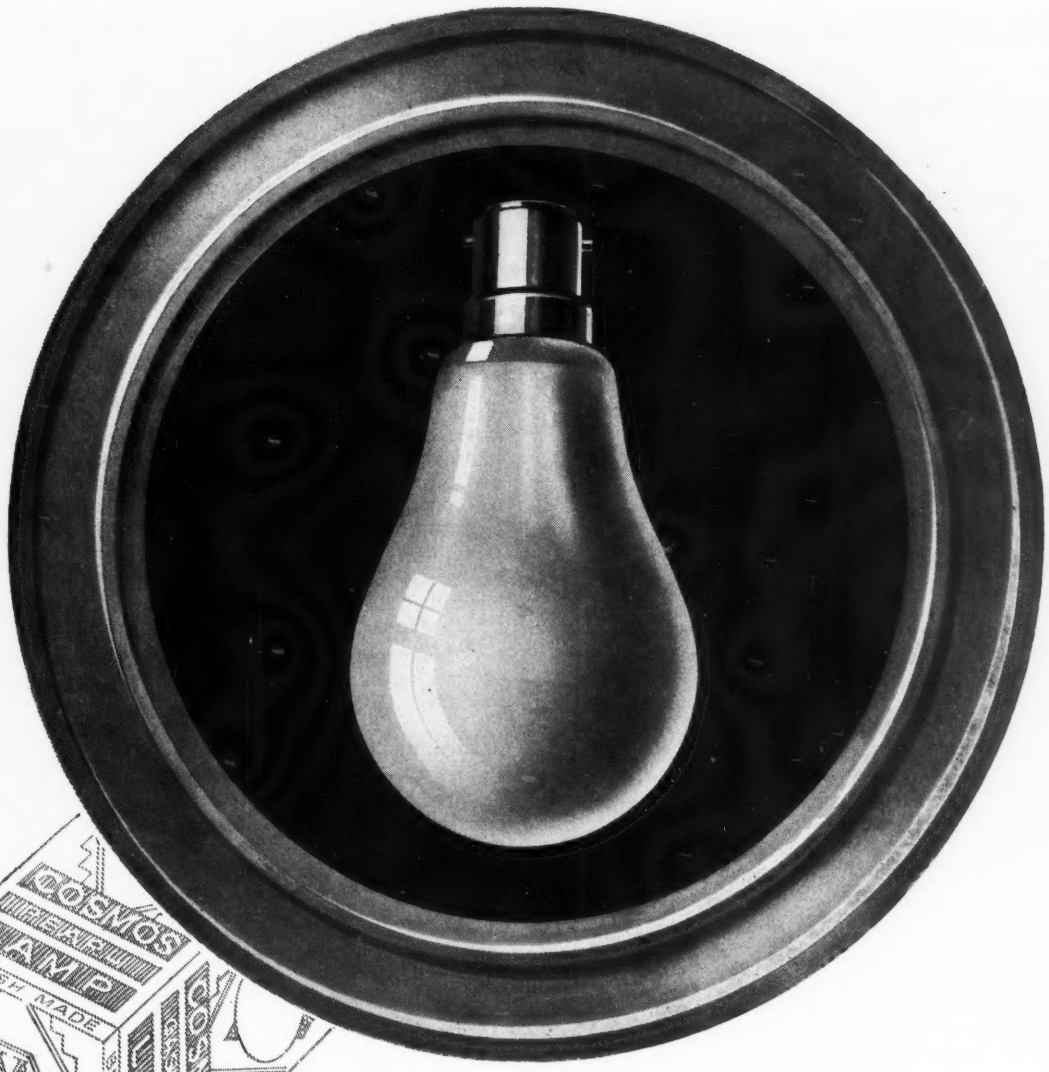
CHANGES OF ADDRESSES, ETC.

We are asked to mention that, from Monday, November 17th, onwards, the Belfast branch of the B.T.H. Company was transferred from 31, Linenhall Street, to 38, Queen Street—a convenient and more centrally situated site, where ample stocks of all types and sizes of Mazda lamps will be maintained.

We are also requested by Messrs. Siemens Electric Lamps and Supplies Ltd. to mention the alterations made in two branch telephone numbers. These are now as follows :—

Birmingham Branch : Midland 6871 and 6872.

Bristol Branch : Bristol 9945 and 9946.



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SINCE the year 1909, when the Illuminating Engineering Society was founded in London, it has been the official organ of the Society.

IT is *the only journal in this country exclusively devoted to Lighting by all Illuminants.*

IT receives the assistance of contributors who are leading experts on illumination in this country and abroad. Foreign Notes and News will be a speciality, and correspondents have been appointed in all the chief cities of the world.

THE Journal contains *first-hand and authoritative information on all aspects of lighting;* it has also been improved and extended by the inclusion of a *Popular and Trade Section* containing special articles of interest to contractors, gas and electric supply companies, Government Departments and members of the Public.

DISCUSSIONS before the Illuminating Engineering Society which are reproduced in this Journal are participated in alike by experts on illumination and *users of light*, whose co-operation is specially invited.

Good Lighting is of interest to everyone. The Journal is read by engineers, architects, medical men, factory inspectors, managers of factories, educational authorities, public lighting authorities, and large users of light of all kinds.

BESIDES being issued to all members of the Illuminating Engineering Society, the Journal has an independent circulation amongst people interested in lighting in all parts of the world. The new and extended form of the Journal should result in a continual and rapid increase in circulation.

Every reader of THE ILLUMINATING ENGINEER, the Journal of GOOD LIGHTING, *is interested in illumination, and is a possible purchaser of lamps and lighting appliances. Gas and Electricity Supply Undertakings likewise benefit by the movement for Better Lighting, with which the Journal is associated, and which stimulates the demand for all illuminants.*

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The Illuminating Engineering Society.

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Members receive *The Illuminating Engineer*, the official organ of the Society, free.

The Society preserves an impartial platform for the discussion of all illuminants, and invites the co-operation both of experts on illumination and users of light; it includes amongst its members manufacturers, representatives of gas and electric supply companies, architects, medical men, factory inspectors, municipal officers, and many others interested in the use of light in the service of mankind.

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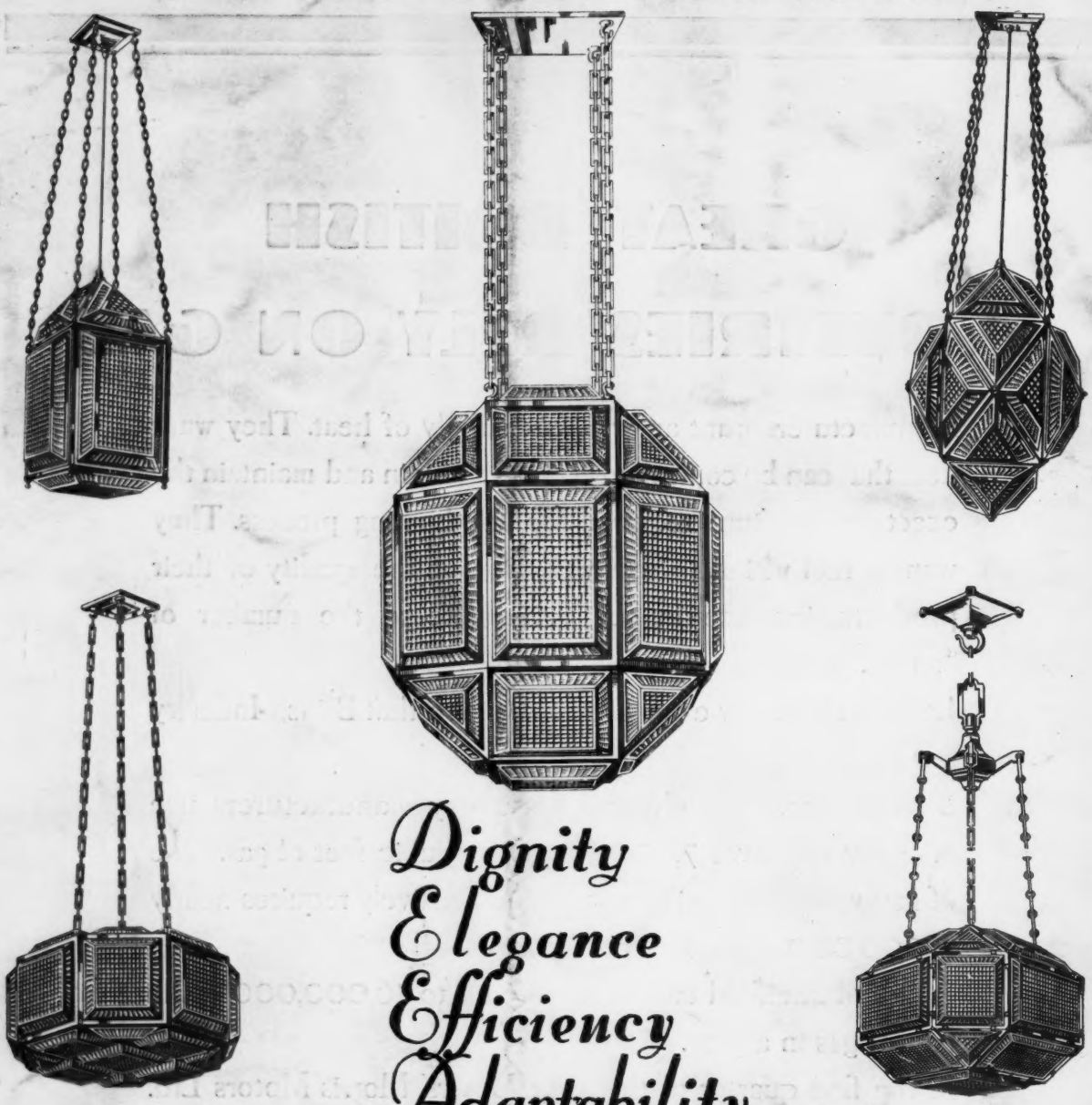

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